Precision Rifle B.I.B.L.E

Volume 2

Nicholas G. Irving Nicholas G. Irving

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To the men of the 75th Ranger Regiment and Joint Special Operations Community who have served, are serving, and will to continue to serve leading the way. All the Way!!!

Contents

History of the “Precision Shooter”

Looking at the variations of rifles, optics, and tactics available to us in this day and age, we can see how precision shooting is becoming a growing past time and interest. During my time serving as a sniper in the United States Army Joint Special Operation Command, I learned that by understanding the history of precision shooting, I could better myself as a tactical shooter whether it is in combat or competition.

“Realizing and understanding that precision shooting has come a long way over time and technology has greatly advanced, we can still learn from our past.”

Sgt. Nicholas G. Irving (Reaper 33)
The Precision Shooter

Precision shooting started on September 19, 1777 at the battle of Saratogo, also known as the Battle of Freeman’s Farm, where the Colonists hid in the trees and used early model rifles to shoot British officers. The most notable shot taken, was the shot from Timothy Murphy, who killed General Simon Fraser on October 7, 1777 at a distance of 400 yards.

A 400 yard shot to us today may not seem that far, but let’s acknowledge the fact that this skill set was relatively new, and looked at as a cowards way of fighting a war. There were no ballistic apps, formulas, DOPE charts, etc. This 400 yards shot would be equivalent of shooting a “cold bore” shot at 700 or 800 yards today, with a .308, and no ballistic apps. A sure feat in its entirety.

On May 9, 1864 during the Battle of Spotsylvania Court House, General John Sedgwick was killed at a range of about 1,000 yards after saying the enemy “couldn’t hit an elephant at this distance.” Not only did this cause mass confusion, it also had a physiological effect on the enemy, just as a sniper in the battlefields of today’s wars.

The first British sniper unit began life as Lovat Scouts, a Scottish Highland regiment that earned high praise during the Second Boer War (1899–

1902).The unit was formed by Lord Lovat and reported to an American, Major Frederick Russell Burnham, the British Army Chief of Scouts under Lord Roberts. Burnham fittingly described these scouts as "half wolf and half jackrabbit.". Just like their Boer scout opponents, these scouts were well practiced in the arts of marksmanship, field craft, and military tactics. They were the first known military unit to wear a ghillie suit. They were skilled woodsmen and practitioners of discretion: "He who shoots and runs away, lives to shoot another day." After the war, this regiment went on to formally become the British Army's first sniper unit, then better known as sharpshooters.

German snipers were as the only snipers in the world at the time issued with purpose manufactured sniping ammunition, known as the 'effect-firing' SS round. The 'effect-firing' SS round featured an extra carefully measured propellant charge and seated a heavy 12.8 gram (198 gr) full metal jacketed boat tail projectile of match grade build quality, lacking usual features such as a seating ring to further improve the already high ballistic coefficient of .584 (G1). For aiming optics German snipers used the Zeiss Zielvier 4x (ZF39) telescopic sight which had bullet drop compensation in 50 m increments for ranges from 100 m up to 800 m or in some variations from 100 m up to 1000 m or 1200 m. There were ZF42, Zielfernrohr 43 (ZF 4), Zeiss Zielsechs 6x and other telescopic sights by various manufacturers like the Ajack 4x, Hensoldt Dialytan 4x and Kahles Heliavier 4x with similar features employed on German sniper rifles. Several different mountings produced by various manufacturers were used for mounting aiming optics to the rifles. In February 1945 the Zielgerät 1229 active infrared aiming device was issued for night sniping with the StG 44 assault rifle. In the United States Armed Forces, sniper training was only very elementary and focused on being able to hit targets over long distances. Snipers were required to be able to hit a body over 400 meters away, and a head over 200 meters away. There was almost no concern with the ability to blend into the environment. Sniper training varied from place to place, resulting in a wide range of qualities of snipers. The main reason the US did not extend their training beyond long-range shooting was the limited deployment of US soldiers until the Normandy Invasion. During the campaigns in North Africa and Italy, most fighting occurred in arid and mountainous regions

where the potential for concealment was limited, in contrast to Western and Central Europe.

The U.S. Army's lack of familiarity with sniping tactics resulted in disastrous effects in Normandy and the campaign in Western Europe where they encountered well trained German snipers. In Normandy, German snipers remained hidden in the dense vegetation and were able to encircle American units, firing at them from all sides. The American and British forces were surprised by how near the German snipers could safely come and attack them, as well as by their ability to hit targets at up to 1,000m. A notable mistake made by the green American soldiers was to lie down and wait when targeted by German snipers, thus allowing the snipers to pick them off one after another. German snipers often infiltrated Allied lines and sometimes when the front-lines moved, they fought from their sniping positions, refusing to surrender until their rations and munitions were exhausted.

Those tactics were also consequences of changes in German enrollment. After several years of war and heavy losses on East front German army was forced to rely more heavily on enrolling teenage soldiers. Due to lack of training in more complex group tactics and thanks to rifle training provided by Hitlerjugend those soldiers would often be used as autonomous left behind snipers. While an experienced sniper would take a few lethal shots and retreat to a safer positions, those young boys, due both to disregard for their own safety and lack of tactical experience would rather cave in and fight until they'd run out of ammo or get taken down. While this tactic would generally end in the demise of the sniper, with a heavy human cost hence the nickname "Suicide Boys" given to those soldiers, this irrational behavior would prove quite disruptive to Allied forces progression.

After World War II, many elements of German sniper training and doctrine were copied by other countries.

The modern sniper, sharpshooter, or precision shooter, uses many of the skills learned throughout history to date. Regardless the advancement of technology, I believe that fully understanding the art and history of long range precision shooting, we can better ourselves and give us the edge we need in the field.

The Importance and Science Behind "Dry Fire"

We've all heard to dry fire our rifles, and that the best shooters in the world will always dry fire. Why is this and what's the big deal behind the dry fire?

The more we repeat something, the better we get at it, this much we know is uncontroversial, but still worth looking at and breaking the dry fire down scientifically.

The connection between repeating an action or a skill and then improving, is because of that repetition is a concept that is so natural and intuitive, so well accepted as common knowledge, which we often fail to appreciate the fascinating mechanics behind the process of skill acquisition.

How to Dry Fire

From the novice shooter all the way to the advanced, we've all practiced the dry fire, or at least should. But what is it the correct way? More often than not, those of us who dry fire for minutes or hours on end, we neglect the importance of using our imagination to the fullest.

Sure, we lay down behind the rifle, breath, squeeze the trigger, and repeat the cycle, but what's the purpose of all of this work if we are simply "going through the motions?"

The purpose of dry fire is not to simply go through the motions of simply squeezing the trigger, but to visually imagine the rifle firing. During the dry fire, you should visually in your mind see the target, in your mind hear the rifle firing, feel the recoil of the rifle, see the impact on target, and run the bolt or use trigger reset when the recoil pulse is over. If you train in your brain that with every dry fire, it is actually a "live round", we trick our brains into believing that this is actually the case. The result of this being that once a live round is being fired downrange, we will have alleviated any shooter flinch, anticipation, trigger slap, etc. The process should be

practiced anticipation, trigger slap, etc. The process should be practiced 70 dry fire practices!

We are in all actuality, tricking our brains by getting it used to the dry fire, instead of a live fire. If you’ve ever fired your gun on the range for 10-20 rounds, then go to the dry fire, while looking through the scope you feel your body flinch and the reticle jumps, you have successfully trained your brain the “wrong way”, you want to achieve the exact opposite.

Will Dry Fire Ruin my Rifle?

Whether you are asking your friends, doing an internet search, or reading a sniper manual, you will find all kinds of different answers in regards to damaging the rifle when dry firing. Some advocate using a snap cap at all times when dry firing as to not damage the firing pin.

The answer to the question is yes and no. Yes dry firing your rifle over a period of time will damage your firing pin, but this is only if the shooter is using a rimfire rifle or handgun. In rimfire weapons, the firing pin in most designs will impact the breech face if the weapon is dry-fired. Because of this, precautions (such as the use of "snap caps") need to be taken if such a weapon is to be deliberately dry-fired. It is generally acceptable and yes, fine to dry fire more modern centerfire firearms without a cartridge or snap cap. However, dry firing a shotgun or rimfire firearm can damage the firing pin. Furthermore, damage can occur to the chamber mouth of a rimfire firearm.

Centerfire cartridges are more reliable for military purposes, because the thicker metal cartridge cases can withstand rougher handling without damage. The stronger base of a centerfire cartridge is able to withstand higher pressures than a thin rimfire cartridge. Since centerfire weapons are generally able to withstand such high pressures once the centerfire firing pin strike the centerfire primer, the centerfire firing pin is fully capable of traveling a fraction of an inch and strike air through the dry fire process.

The Science behind Dry Fire

With every action that we perform, every new skill that we pick up in the life as well as with shooting, it involves beating down and refining a neural trail. In fact, we are actually making real changes in our brains. Our brains are extremely efficient to change in response to training. Over time, it is possible to see significant structural changes in the brain.

In a study taken on video gamers who played the dark, fast moving action packed game Call of Duty for 9 weeks straight, were not only better at the game, but were able to see significantly more shades of gray, post-training, than a group who played a simulation strategy game that did not exercise those skills. Similarly, a famous study of London cabbies, famous for their ability to navigate the twisting streets of the city, found that they had greater brain volume in the hippocampus, a structure heavily involved in both memory and spatial navigation, than bus drivers who followed a predefined route every day.

Understanding how the brain neurological pathways can be influence/changed when learning a new task or practicing a task long enough, applying this to the dry fire process, we can successfully change how shooting a live round is perceived by our brain. With the proper dry fire and with the recommended amount of dry fire to live round ratio, we will see a noticeable increase in accuracy, follow through, N.P.A, and decrease in shooter flinch, anticipation, trigger slap, etc.

Unorthodox Shooting Platforms

Unorthodox shooting platforms is something that all “tactical” precision shooters will face one way or another, may it be in a competitive environment or in a combative situation. We may not have the luxury of examining our platform before we arrive at it to shoot, but if we understand the dynamics and basics of unorthodox platform shooting, we can apply it to almost any platform that we may come across.

To understanding shooting on an unorthodox platform, we need to have a basic knowledge of rifle, physics, and the human body. Some of the Unorthodox shooting platforms that we will discuss are the following:

• Various building rooftop structures
• Concrete barricades
• Rolling platforms
• Fences
• Stairway platform

Various building rooftop structures

For precision shooters in the competitive community, or snipers in the law enforcement and military, rooftops may be an all too common structure we may find ourselves up against.

There are a few ways a sniper can tackle this obstacle to provide him with a great amount of stability.

The most commonly used, or preferred method, is a method that will avoid rifle cant, and hop. The shooter can achieve this with the utilization of a sand sock or bag of some sort. The sand sock or bag is placed on the roof structure only to allow the rifle to rest on it. Note that this is nothing more than a rest for the rifle that will prevent canting and hop, and not allowing the rifle to rest on something solid. The body position may vary to some extent, but if the shooter can lay “straight behind the rifle”, this will help absorb recoil, and allow the shooter to watch the impact downrange.

The following pictures will better demonstrate shooting from a roof structure. (Pictures of Tim Milkovich)

Concrete Barricades

When shooting the rifle on a hard or concrete barricade, we know that due to the rifles harmonics, once fired, will cause the rifle to move up and away from the object. In order to alleviate any hop from the rifle, the shooter needs to triple the force holding the rifle into the shoulder pocket. The shooter may also place a rear bag under the stock of the rifle, or on the folded upward bipod legs. If the shooter decides to use the rear bag, only apply about double the force.
In order to double or triple the force holding the butt stock into the shoulder pocket, simply tighten the bicep. Do not tighten the bicep in such a way that it causes trembling.

Rolling Platforms

A rolling platform can be one of the most challenging platforms to shoot from. If the shooters body is canted or offset to one side of the platform, through the rifles recoil, the platforms roll/movement will greatly be exaggerated. In order to alleviate the movement of the rolling platform, the shooter needs to “center up” on the structure and if possible, only allowing the weight of the rifle to rest on the platform. The rifle and the shooter should be in line with the platform as shown in the following picture.

Fences

As with any situation in the precision rifle community, we need to beware of the terms “always” and “never”. You never know what situation you may face in the field, but when faced with that situation, you need to know how to approach it.

When faced with a situation where the target you are engaging lies beyond a fence, and the only support for your rifle that you have available is the fence in front of you, and you must rest your rifle barrel on it, what are your going to do after being told that you never rest your barrel on an object?

There are three things that we must first understand before doing so.

The first being that when we rest our barrel on an object, we are actually bending the metal and disturbing the harmonics of the barrel. Once we touch the barrel on an object, the barrel will naturally move/bend away from the object as the barrel vibrates when fired.

Second, we need to know that the amount of pressure we apply on the rifle while the barrel is resting on an object, will greatly affect how much the barrel bends away from the object, thus greatly increasing the amount of error we see downrange.

Lastly, we need to know that the amount of error we will see downrange is also in relation to where the barrel is resting on the object.

For the serious, tactical precision shooter, you can take your rifle out to a controlled rifle range and document your data when resting the barrel on an object less than half an inch in diameter (or fence). Take note of where the rifle barrel rest as well, and document the changes in bullet elevations. You can document the bullet impacts when the rifle barrel rests near the base (closest to you), the middle potion of the barrel, and the forward section of the barrel. This should be done at the 100, 200, 300, 400, and 500 yard lines.

Stairway platform

This platform is also an all too common structure seen in the competitive precision rifle community. The structure resembles a stairway, usually constructed of plywood. Depending on the structures durability, the shooter can actually benefit in accuracy from this platform. The platform forces the shooter to shoot from three different positions, kneeling, crouched/hunched, and standing (strong side and support side).

No matter the position the shooter is forced into, the basics do not vary.
If the shooter is forced into the kneeling position using the bottom stairway,

there are a few things to consider.

- The shooter utilizes the rear bag as support (hard on soft).
- The shooter utilizes the bipods to apply forward pressure, or to apply a pulling force on the rifle. This is done by either extending the bipods and pushing them on the portion of the structure closest to you (applying pressure), or by resting the bipods on the outer portion of the structure, allowing the shooter to pull the rifle into the shoulder (greatly reduces recoil, and allows the shooter to see impact).
- The knee that is under the firing elbow is used as a rest for the firing elbow. We often see that a shooter will do the exact opposite, causing the firing elbow to “float”, thus exaggerating the sway in the reticle.

- The shooter is squared to the target. This ensures that the shooter is not bladed to the target, exploiting unnecessary angles that will cause rifle hop.

In the standing and crouching position, the shooter should also remain square to the rifle, not bladed.

The picture on the following page demonstrates the proper kneeling stairway structure position. Note that the shooters firing elbow is resting on the knee directly underneath. This will give the shooter the most stability. Also note that the shooter utilized the rear bag as a rest (hard to soft).

(Photo of Regina Milkovich. Top 100 Precision Rifle Competitors.)

Special/Advanced Environmentals

As we all know by now, environmentals is one of the precision rifle shooters greatest challenges to overcome. Environmentals can give the precision shooter enough problems as it is when calculating and adjusting for them, but what if we throw rain or snow into the environmental factor?

Rain/Dust Particles/Snow

I’ve been asked on multiple occasions, “Does rain/snow effect the bullet? and how do I adjust for it?” Some precision shooters absolutely freak out when it starts to rain, or may even go as far as not shooting in these conditions.

I like to look at rain, to a certain extent, the way I look at wind, “just shoot in it!” Where many precision shooters will not shoot in high winds due to its unpredictability and challenge, they treat rain the in the same fashion.

Not much information is given on the effect of rain on a projectile, for what reason I’m not sure, but understanding projectiles and physics, we can easily determine how rain will affect our shot.

The answer to the question is yes and no. Rain will affect the bullet as it travels downrange to the target, but only at a certain point in its travel.

I had an in-depth conversation with a naval officer who operated a submarine for several years and I discussed the effects of water on missiles as they exit the sub while submerged. This discussion gave me an idea of how a bullet may be affected by water particles (rain) to some extent.

When the first concept of a submarine launched missile was proposed in 1955, skeptics said that it would never work. After a successful test launch from the USS George Washington on July 20th 1960, of the Polaris missile it ushered in the new era of how submarine warfare will be raged. As the missile is launched from the submarine it releases gases that surround the missile while submerged. The gases prevent the missile from ever actually touching the water surrounding it.

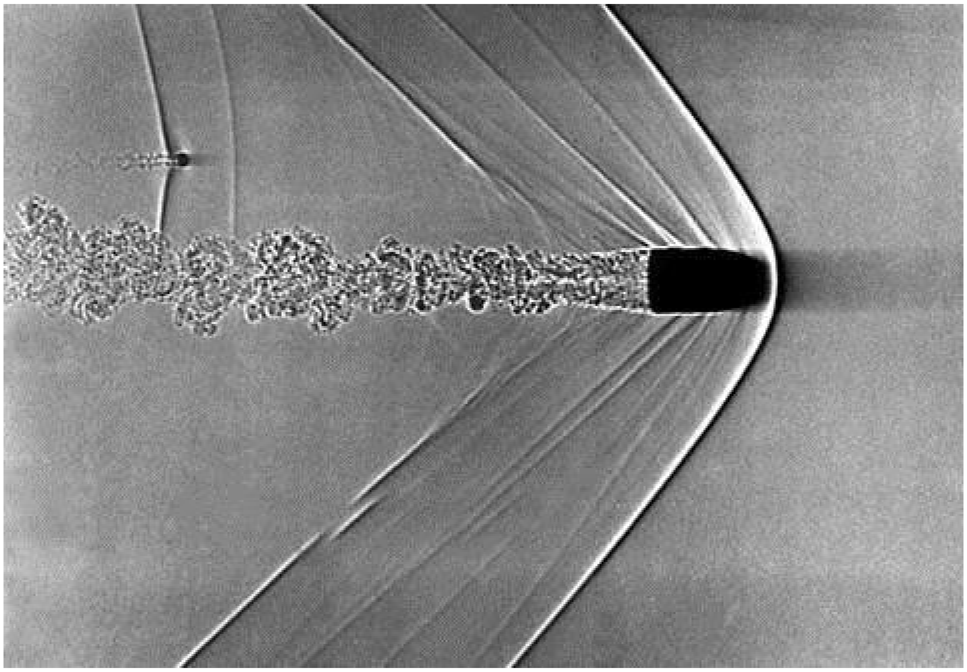
The bullet operates in somewhat the same fashion. As the bullet leaves the barrel, it is traveling at speeds well exceeding that of sound. Being that the bullet is traveling faster than the speed of sound (an excess of Mach 1), it creates a supersonic shock wave around it (Fig, 14-6).

This shockwave surrounding the bullet, is the result of air being greatly compressed at the front-most tip of the bullet as it slices through the air. As the bullet moves forward, a broadening wave of compressed air trails out diagonally from the bullet tip. The sides of the bullet create a conical waveform.

Being that the bullet has its own protective cone around it, dispersing air in a cone fashion; water particles will never touch the bullets surface as it is being deflected by the supersonic shockwave.

The problem lies when the bullet becomes subsonic or is in the transonic state of flight. As the bullet transitions from supersonic to subsonic, the “protective cone” around the bullet starting at the nose, begins to fall back towards the tail of the bullet, thus exposing the bullet to particles in the air. Recorded data has been somewhat difficult to gather as how the rain will affect the bullet due to the fact that the bullets performance from supersonic to subsonic is nearly unpredictable.

Snow will act in the same manner as rain. Although, in snow, the result of lower temperatures must be accounted for.



Understanding and Shooting in Mirage

Mirage is a naturally occurring optical phenomenon in which light rays are bent to produce a displaced image of distant objects. A mirage is extremely noticeable when observed through optics, such as a spotting or sniper scope, since light rays actually are refracted to form the false image at the shooter or observers location.

What causes Mirage?

Cold air is denser than warm air and has therefore a greater refractive index. As light passes from colder air across a sharp boundary to significantly warmer air, the light rays bend away from the direction of the temperature gradient. When light rays pass from hotter to cooler, they bend toward the direction of the gradient. If the air near the ground is warmer than that higher up, the light ray bends in a concave, upward trajectory, and something we commonly see through our rifle optics. In the case where the air is cooler on the ground or near the ground than that higher up, the light rays curve downward.

There are three types of mirage: inferior, superior, and Fata Morgana. The type of mirage that refers commonly to us as precision shooters is the inferior mirage.

The inferior mirage is also known as the highway mirage, or a desert mirage, and looks as if water or oil is near or on the target that we are observing. In inferior mirages, the image of a target will be distorted. It may be vibrating; it may be vertically extended (towering) or horizontally extended (stooping). If there are several temperature layers, several mirages may mix, perhaps causing double images.

Another type of mirage that precision shooters may encounter, is something known as barrel mirage. Barrel mirage occurs as the barrel heats up over a period of time, typically when the shooter fires 20+ rounds without a short break in between shots. The barrel mirage will occur faster when the shooter uses a suppressor, and typically occurs when the shooter fires an excess of 10-15+ rounds without a sustained break inbetween shots.

When you shoot on a hot day and your rifle barrel gets hot, the heat rising from the barrel can make the target waver around and harder to see. The fix to this problem is a simple barrel or suppressor cover or a small strip of cloth placed over the barrel/suppressor. TabGear© makes an awesome suppressor cover that is used within the military, Special Operations, Law Enforcement, and civilian precision shooters community. The TabGear© suppressor cover is designed to prevent mirage from obscuring your site picture after multiple shots. Their suppressor cover eliminates mirage by the use of insulating materials. The outer shell of the cover will not heat up so your equipment and person will not become damaged with accidental or intentional contact. With the use of the cover, the precision shooter/sniper can easily remove the suppressor, or change barrels when or if the situation presents itself without harm to the shooter.

(TabGear© Suppressor Cover)

Shooting in Mirage?

How often have we been on the range where mirage is prevalent, and while looking through the scope, no matter what power setting the scope is on, the target appears to jump from its point of origin?

Mirage moves the apparent location of the target, mostly upward, so that if the shooter was to aim and shoot at the center of the target when the mirage is occurring, the bullet impact will be high, or completely missing the target completely. Although there is a horizontal problem that we will encounter, the greatest displacement in bullet impact will be high. If there is wind during the mirage (which more than likely will be), the image of the target will appear to also move left and right as well, in addition to the upward

motion. If there is a lot of wind and mirage is present, the target may also appear to completely disappear behind a wall of “water vapor”. This will present a problem when the shot we take counts the most.

As discussed earlier, when the shooter is shooting in a heavy mirage, the shot placement will be high on target, or a complete miss. We need to determine where the target actually is.

When observing a target through a mirage, may it be heavy or light, take a look at the target. To reduce the density of the mirage seen through the scope, try to zoom down on the power level. If you are utilizing a rifle scope with power settings that exceed 15X, take the power level down to a setting of around 10-12X. While looking at the target through this setting, the target may appear less “jumpy”, or clearer.

If the target still appears to be “jumpy” or shifting, there is a general rule of thumb used in order to prevent shots impacting high or missing altogether.

The rule of thumb to be considered when shooting at a target that may present itself as “jumpy” or shifting is to “index the target”. Indexing the target, in simplified terms, is explained as, finding/locating the targets point of origin through shift and change through mirage. Since our target is a stationary target at its base (not leaving the ground), we can find its point of origin even while looking through the mirage shift.

In order to find the targets point of origin, we need to first determine the direction of the mirage, or in other words, find the way the mirage is blowing in relation to the ground. If the mirage is moving in an upward manner and at a slight angle, the target will appear to be higher and left or right of where the target actually is.

Once we find the direction of the mirage, we may now start to locate the origin of where the target is. This is first done by finding the corner, or corner base of the target that is nearest to the mirages base. This can be somewhat of a challenge to find depending on the density of the mirage, and will usually give present the target as jumping to the shooter. If the target is jumping/shifting in the mirage, the shooter will notice a “constant”. The constant is in relation to the target. The constant, is where the target corner

will always shift to through mirage, while the remaining portions of the target will vary in space (top sections of the target are never consistent in space). The shooter can use a point of reference behind the target to determine where the targets consistency lies.

Once the targets point of origin actually is, the shooter may then, in his mind, impose the mirage target onto the point of origin. This becomes easy with practice and especially if the target dimensions are known.

The shift in the bullets desired impact depending on the density and consistency of the mirage, can vary anywhere from .1 to .8 MILs when mirage has not been taken into
consideration.

Classifying The Mirage Density

The sight corrections needed to compensate for a mirage, at a given range, will increase as the density of the mirage increases. The shooter should be able to distinguish different densities of mirage, which can also be recorded in a data book for future reference.

For the use of precision shooting, we can use three categories to classify the mirage density, namely: light, intermediate, and heavy.

The light mirage is associated with a cool or cloudy day, when the sun cannot heat the ground and is seen through the spotting scope as a series of fine, faint lines. Target distortion is minimal. This mirage is very useful to the shooter in detecting slight wind changes which require the merest pinch of windage adjustment; while the mirage correction, which will be shown later in this manual is practically negligible.

An intermediate mirage will be present on the perfect shooting day with 70 to 75 degree temperature and normal relative humidity (45 to 55 percent). The mirage is barely perceptible with the unaided eye, but is easily seen through the spotting scope as distinct lines. Target distortion begins to be apparent and each major change in wind velocity will also require a correction for the change in mirage. Conditions are more difficult than those brought about by a light mirage, but are not the most difficult.

A heavy mirage will occur on hot, sultry days (60 to 75 percent humidity) when heat waves can be seen easily with the unaided eye, and appear as very dense lines viewed through the spotting scope. Target distortion is extreme, small bullet hole spotters are difficult to locate, and any change in the wind velocity will require that the shooter take into consideration the mirage corrections.

The relation of mirage and wind velocity:

- Vertical Mirage: 0 MPH
- 30 Degree Mirage: 1-3 MPH/2-5 KPH
- 45 Degree Mirage: 4-7 MPH/6-11 KPH
- 90 Degree Mirage: 8+ MPH/12+ KPH

How can you Calculate Mirage?

This formula is typically used when a slow mirage is present, since a slow mirage gives the shooter the greatest target shift or “jump”.

A slow mirage, exist during a light air of 1-3 M.P.H. blowing from 3 o’clock or 9 o’clock. The heat waves will be slightly inclined as they move across the target from 7 o’clock to 1 o’clock or from the 5 o’clock to 11 o’clock. The target displacement with the slow mirage requires both an elevation and windage correction.

Since the heat waves are crossing from 7 o’clock to the 1 o’clock, or the 5 o’clock to 11 o’clock, they are making an angle of 30 degrees with the vertical, and their vertical and horizontal components.

This can be computed in relation to the total apparent displacement where:

P = total apparent displacement V = vertical component of D H = horizontal component of D

Then, V = D cosine 30 degrees = 0.87 D (displacement), and H = sine 30 degrees = 0.50 D (displacement)

Experience has shown the total displacement due to heavy mirage amounts to be ≈ 1 ½ minutes. The vertical correction due to heavy-slow mirage will

be 1.31 or 1 ¼ minutes, and the horizontal correction will be 0.75 or ¾ of a minute.

As the 3 or 9 o'clock wind rises to a light breeze of 4 to 7 miles per hour, the heat waves will make a greater angle with the vertical and will have the appearance of crossing from 8 o'clock to 2 o'clock or 4 o'clock to 10 o'clock. This gives the third classification, is a medium mirage. The medium mirage will also require both elevation and windage corrections of different amounts than for slow mirage. Changing the angle from 30 degrees to 60 degrees because of the increased inclination, the corrections become:

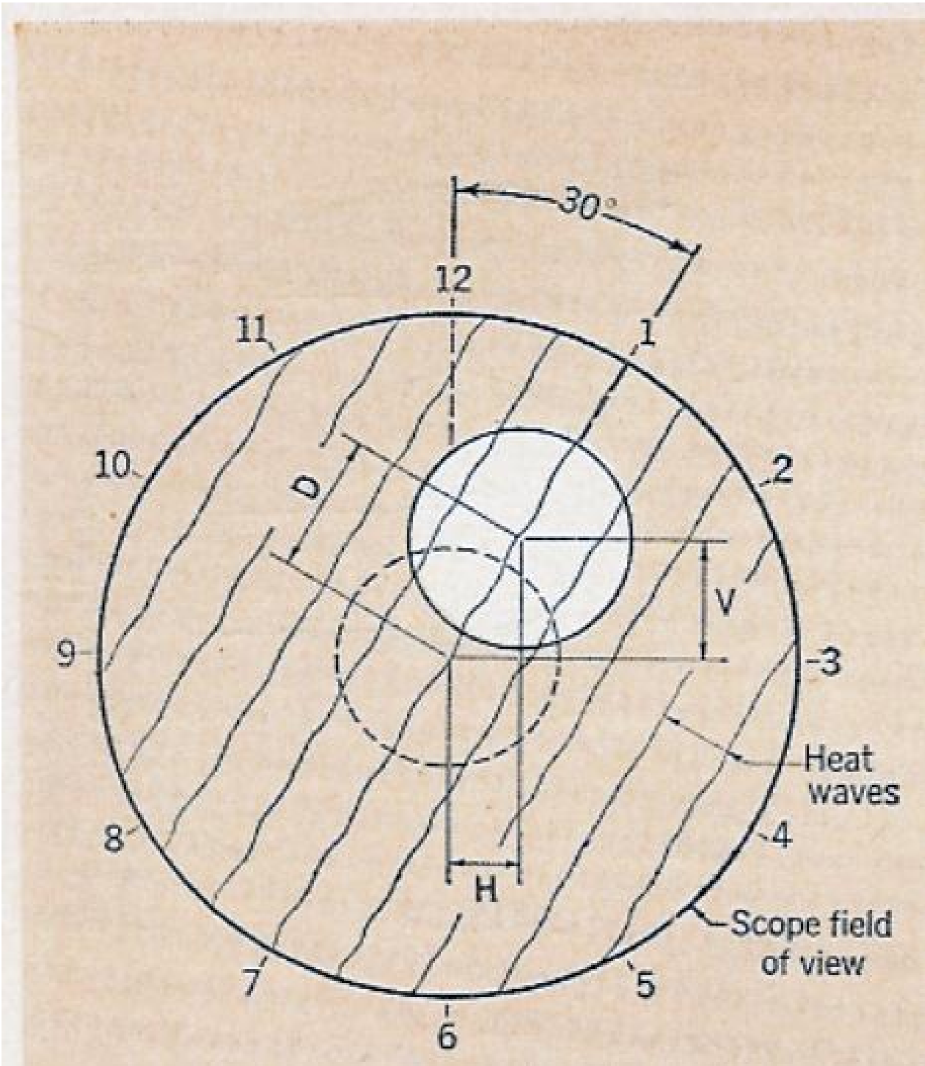
V = D cosine 60 degrees = 0.50 D and
H = D sine 60 degrees = 0.87 D

Going back to the total displacement of 1 ½ minutes caused by the heavy mirage, the vertical correction for a heavy-medium mirage will be 0.75 of ¾ minute and the horizontal correction will be 1.31 or 1 ¼ minutes. The elevation turret is lowered and the windage correction is added to that required for wind drift.

*** If you have known MOA data and are now using the MIL scope, you can just convert it by dividing by 3.44. So if your 500 yard dope is 12 MOA then:

12 / 3.44 = 3.48 or rounded to 3.5 mils so you dial on 3.5 MILs. Or 200 yard data is 2 MOA so:

2 / 3.44 = .58 or round to .6 mils***



Mirage classification: Slow Target Displacement: “D” and is oblique 30 degrees. Horizontal Correction: “H” = 0.50 D
Vertical Correction: = 0.87 D

Hand Load Ammunition

Economy, increased accuracy, performance and hobby are common motivations for hand loading cartridges. Reloading fired cases can save the shooter money, or provides the shooter with more, and higher quality, ammunition within a given budget. Reloading may not be cost effective for occasional shooters, as it takes time to recoup the cost of the required equipment, but those who shoot on a regular basis will see benefit as the brass case (the most expensive component) can be reused many times (with proper maintenance). Besides economy, the ability to customize the performance of the ammunition is a common goal. Precision target shooters seek the best achievable accuracy, as well as the best shot-to-shot consistency.

There are three aspects to ballistics: internal ballistics, external ballistics, and terminal ballistics. Internal ballistics refers to things that happen inside the firearm during and after firing but before the bullet leaves the muzzle. The hand loading process can increase accuracy and precision through improved consistency of manufacture, by selecting the optimal bullet weight and design, and tailoring bullet velocity to the purpose. Each cartridge reloaded can have each component carefully matched to the rest of the cartridges in the batch. Brass cases can be matched by volume, weight, and concentricity, bullets by weight and design, powder charges by weight, type, case filling (amount of total usable case capacity filled by charge), and packing scheme (characteristics of granule packing).

In addition to these critical items, the equipment used to assemble the cartridge also has an effect on its
uniformity/consistency and optimal shape/size. Dies used to size the cartridges can be matched to the chamber of a given rifle. Modern hand loading equipment enables a rifle owner to tailor fresh ammunition to a specific firearm, and to precisely measured tolerances far exceeding the comparatively wide tolerances within which commercial ammunition manufacturers must operate.

In the precision rifle community and talking to Tactical Matches.com, (home of some of the best precision shooters in the nation), a common topic is talked about is, “what is the best ammunition possible to shoot?” Some precision shooters emphasize that hand loads excel over the mass manufactured precision rifle rounds. The following sub topics will help us to determine the question asked.

Hand Load Accuracy Theory

Every rifle barrel develops some sort of harmonic vibrations when the cartridge is fired. A rifle barrel’s vibration can also be somewhat described as a 3-dimensional wave, or corkscrew movement and is caused when the bullet is accelerated into a rapid spin caused by the rifling inside the barrel. This can be seen on high speed film and is pretty impressive we are able to hit anything with the amount of barrel movement present.

It is impossible to fully eliminate all barrel moving, even if the rifle has one of the thickest barrels in production. Even thick barrels will vibrate with every shot and any velocity variation will alter where the muzzle is finally located when the bullet exits. The random movement of the muzzle will give some sort of deviation and rise to increased group size, which is the reason we see larger groups at distance. The most experienced rifle builders will always allow the barrel to flex, given the idea that if the barrel’s movement cannot be eliminated, the next best solution is to have flex/harmonic consistency. Some of the best rifles in production have their actions and the first inch or so of the rear of the barrel bedded tightly into the stock to hold the receiver firmly, with the remainder of the barrel free floated. In addition, short, thick barrels have the wide(r) nodes so velocity isn’t as critical to achieving a sweet spot.

Since the velocity of the bullet passing through the barrel effects the way it flexes, accurate loads should deliver as consistent a velocity from shot to shot as is possible so that the bullet exits the muzzle at the same point in the “flex”. You can control this to a certain degree, but is impossible to entirely eliminate shot to shot velocity deviation. At around a variation of 10 to 12 f/s, it may become almost impossible to reduce the effect any further.

It has long been understood that barrels perform best within certain velocity ranges. These velocity ranges are commonly referred to as a "harmonic nodes" or "sweet spots". The reason for this is that the tensile strength (or the ability to resist further bending) of the metal alloy increases as it moves further away from its static state. The barrel gets stiffer when it is forced to the extremity of its movement. At the point of maximum movement, slight velocity variations change the muzzle location less; resulting in lower shot dispersion and thus a smaller group size. What most shooters don't understand is the harmonic vibration is related to the mass of the bullet. Therefore, once the harmonic node(s) for a given weight bullet is identified, a lot can be learned, if you know the velocity. There is also a new theory of "barrel timing" being developed based upon data obtained from strain gauges. Upon firing, the chamber swells slightly and an annular ring of expansion travels down the barrel causing the bore to expand slightly and this effect continues as the expansion reflects back and forth along the barrel diminishing with each passage. Initial data suggests that not only should a load perform best at one of the velocity nodes, but that the bullet should not exit the muzzle at the same time that the expansion ring reaches the muzzle as the slight increase in bore size adversely affects accuracy.

The Importance of Load Development, equipment, and the Hand load Process

Precision rifle shooters thrive on, “the perfect bullet”, for the reasons of optimal performance and accuracy. In order for the shooter to get the type of accuracy they are looking for, they turn to load development.

Some of the top shooters in the nation practice hand loading and have seen some great results in return. Having the capability to precisely measure and examine every component within the hand loading process, gives the shooter to “hard data”, unlike some commercial marketed rounds. Having the capability to hand load, will also give the shooter the capability to produce a round that will function exceptionally for whatever environment he desires. Some hand loaders will produce a round that works extremely well in a precision rifle competition (low recoil, flat trajectory, etc.), but not perform to a standard needed for long range hunting (insufficient kinetic energy).

I believe that precision rifle shooters must understand that a proper hand loaded round may far exceed the accuracy and performance of almost any major/popular rifle cartridge on the market today, given the fact that the shooter understands the process of hand loading entirely.

Equipment Needed:

- Presses
- Dies
- Scale
- Shellholders
- Priming Tool
- Bullet puller
- Powder measure
- Case Trimmer
- Primer Pocket Tools

The Hand load/Reload Process

• The operations performed when hand loading are:
• Case cleaning (optional, recommended for fired cases)

• Case inspection (Look for cracks or other defects, and discard visibly imperfect cases. Bent case mouths may be repaired during resizing.

• Lubricate cases (Carbide dies do not require lubrication.)
• Size/Resize the case (For previously fired cases, primers are pressed out in this step with most die sets.)

• Ream or swage crimp from primer pocket (reloading military cases only), or mill the primer pocket depth using a primer pocket uniformer tool

• Measure and trim the case length (as needed; rarely required with handgun cases)

• Deburr, ream case mouth and size case neck (optional, as-needed; trimmed cases need to be deburred); some bench rest shooters also do

outside neck turning at this stage, to make the cartridge case have uniform thickness so that the bullet will be released with the most uniformity

• Clean primer pocket (optional; primer pockets will have deposits from combustion) and do flash hole uniforming (optional, generally, only bench rest shooters do this)
• Expand or chamfer case mouth (not required with boattail rifle bullets)

• Clean the lubricant from the cases

• Seat a new primer (primer pockets often become loose after multiple loadings; a lack of effort being required to seat new primers indicates a loose primer pocket; cases with loose primer pockets are usually discarded, after crushing the case to prevent its reuse)

• Add a measured amount of powder (critical step; incorrect powder charges are extremely dangerous, both underweight as well as overweight)

• Seat the bullet in the case for the correct cartridge overall length (OAL) and for aligning bullet cannelure (if present) with case mouth

• Crimp the bullet in place (optional; some may hold the bullet with neck tension alone)
• Cartridge inspection

Most reloading manuals list their loads starting with the fastest powders and work down to the slower powders. The powders have been selected as only suitable, and are based in part on the loading density. If you are starting out by having to purchase powder, select one of the powders in the middle or slow end of the loading data list suitable for the bullet you will be using.

At your work station, start by separating the brass by the brand or military manufacture/date stamp head.

Clean, resize, trim (nominally to .01" less than the maximum allowable case length as specified in your load manual--the actual length is not as important as is the lengths being uniform), and prime about 100 pieces of

the same brand of brass with your favorite primer. Be sure that you use the same primers and bullets for all the cases.)

Check your loading manual and determine the maximum charge suggested for your powder. Now determine how much adjustment on the powder measure will throw about 1 percent or slightly less of the weight of maximum charge of powder. (As an example, if the maximum load was 45.3 grains, you would determine the amount of adjustment of the measure that would give you about a 4/10 to 5/10 grain increment--often about 1/4 to 1/2 turn of the adjustment). Then, set your powder measure to throw a charge in the lower third of the charge weight range as recommended by your loading manual. Also note the maximum velocity indicated in your load manual so you have some idea of when you are approaching a maximum load.

Now seat the die so that bullets will be seated 10 to 20 thousandths off the lands or to the workable maximum overall length if they will be used in a magazine fed firearm. Be sure to check your seating plug to insure that is bears only on the ogive of the bullet and not the tip. Because bullet tips vary slightly in shape seating a bullet by means of its tip leads to varying seating depths. It may be necessary to alter the seating plug by drilling it out slightly so it bears only on the ogive. Some manufacturers will custom cut seating plugs for you.

Setting a seating die for the "overall length" should be done using one of the gauges that measure from the ogive and not the tip of the bullet. Sinclair and others make inexpensive gauges for this or you can fashion your own.

Head for the range with bag of primed cases, bullets, powder, powder measure, a single stage press, a seating die, and a "permanent" type marking pen. All you will be doing is throwing powder charges and seating bullets, so how you mount the press and measure so it is useable at the range is up to you.

Load your first five rounds, and using proper shooter fundamental basics, fire them at an aiming point through the chronograph. Record group size, the velocity and the standard deviation for the string. Increase the charge one "increment" by turning your adjusting screw on your powder measure

as described above and shoot 5 more rounds at a separate aiming point. Continue this process until you start seeing signs of high pressure or reach maximum velocity.

If you squeeze out an excellent group, load one sample round with that load and label before adjusting the measure so you can weigh it later.

As velocities increase you should see obvious changes ingroup size. It should be readily apparent when you reach a velocity node the barrel likes. However, don't stop at the first point where you get a tight group as most rifles have two or more nodes. As you pass through each node, groups will open up again until you approach the next node. Stop only when you are at maximum velocity or pressure. Once there, you should have identified rough velocity nodes for the bullet's weight.

Importance of the Chronograph

In the days of yore (BC -- before chronographs), it was necessary to blindly hunt for loads that worked. Once a good load was found, changing any component could render the whole process useless (since changing components varies pressure and velocity) and one pretty much had to start from scratch if anything changed. A chronograph provides direct insight into what your loads are doing, and what you need to do to make them work better. You will be able to immediately determine if a changed component produces velocity outside of the range the barrel likes. In most cases simply adjusting the powder charge will correct the problem.

One of the best chronographs on the market is the CED Millennium 2 Chronograph. It is extremely accurate and stable, interfaces with RSI's Shooting lab software, and can be fitted with infra-red sensors which will "see” bullets under conditions (including total darkness) that would fail on other chronographs.

Measuring muzzle velocity is crucial for finding and identifying the most accurate load for your rifle, whether you reload or use factory ammo. Also, critical trajectory data can be gathered from this information.

The chronograph will also tell you if you are getting velocities higher than that of the reloading manuals, helping you to avoid dangerously high pressure building up in your rifle. The price for a good chronograph ranges from $90 to $300.00. The chronograph has two or three metal wire sensors on top of a sturdy metal casing that houses a computer that measures the velocity of your bullet (or arrows, pellets, etc.) as it travels through the sensors, in feet per second (fps) and will also record the number of shots, the high velocity, the low velocity, extreme spread (ES), the average velocity, and standard deviation (SD). The “high” reading shows the fastest shot, the “low” reading shows the slowest shot, the “average” gives you the average of five shots or ten shots (called the shot string or ‘string’). The extreme spread (ES) is the fastest shot minus the slowest shot. The (ES) goal for the long distance hunter should be within 30 fps or better. And 20 fps puts you at the beginning of competitive bench rest shooting. There is also standard deviation (SD) which is the measure of how close each shot’s velocity in the shot string will be to the “average.” For the longrange marksman, 9 to 12 fps is good. The lower the (SD), the better.

Because factory ammo is already made, it is impossible to enhance the data of factory ammo. All the components of factory ammo come fixed. The best you can do with factory ammo is find the brand that shoots the smallest group, and when you do; buy up all of that particular lot and brand of that ammo. You will still be able to extend your shooting distance with factory ammo. The limit being, as far out as you can effectively “practice and confirm" your maximum shooting distance.

When testing with reloads or several different brands of factory ammo, the idea is to shoot the smallest shot group you can at 100 yards and use the data to determine which load or which brand of factory ammo is consistent. Keep this data, as you will need it later. Once the best hand-load or brand of factory ammo is found, shoot a couple of “strings” out at 300 yards and see how your shots group there. The goal should be 2.50 inches or better at 300 yards. This is “sub “minute-of-angle. A One inch group at 300 yards puts you at the beginning of competitive bench rest shooting. A ½ inch group at 100 yards is very good; and a 1/4 inch group or all five shots inside of one hole is an excellent platform for a long-range rifle. If the chrono readings

stay the same, and the shot groups remain small, you have a rifle that can be made to shoot at longer distances.

The Perfect Rifle Cartridge

The perfect rifle cartridge/projectile in the precision rifle community would be the one that has no or very minimal vertical deviation at distance, as well as a projectile that has the least deviance in the horizontal plane. Since there is no such thing as a perfect bullet, we can take a look at a few cartridges and their characteristics that are as good as they come.

A bullet with a high BC arrives at the target faster and with more energy than one with a low BC. Since the higher BC bullet gets to the target faster, there is also less time for it to be affected by any crosswind.

Ammunition makers often offer several bullet weights and types for a given cartridge. Heavy-for-caliber pointed (spitzer) bullets with a boat tail design have BCs at the higher end of the normal range, whereas lighter bullets with square tails and blunt noses have lower BCs. The 6 mm and 6.5 mm cartridges are probably the most well known for having high BCs and are often used in long range target matches of 300–1000 meters. The 6 and 6.5 have relatively light recoil compared to high BC bullets of greater caliber and tend to be shot by the winner in matches where accuracy is key. Examples include the 6mm PPC, 6mm Norma BR, 6x47mm SM, 6.5x55 Swedish Mauser, 6.5x47mm Lapua, 6.5 Creedmore, 6.5 Grendel, .260 Remington, and the 6.5-284. The 6.5 mm is also a popular hunting caliber in Europe.

In the United States, hunting cartridges such as the .25-06 Remington (a 6.35 mm caliber), the .270 Winchester (a 6.8 mm caliber), and the .284 Winchester (a 7 mm caliber) are used when high BCs and moderate recoil are desired. The .30-06 Springfieldand .308 Winchester cartridges also offer several high-BC loads, although the bullet weights are on the heavy side.

These rounds are not only known for their relatively flat trajectory and velocities, they also do not have a large variance in regards to “fp/s”. A good round will have a velocity variance of only 4 fp/s.

Fine Tuning your Hand Load

Now let's say that your hand load is complete. How can we fine tune our hand load to achieve at its prime?

We should note that changing any component will affect the bullets performance. Bullets of the same weight but differing brand or shape will produce different velocities with the same powder charge. This anomaly is due to differences in jacket thickness, bullet bearing surface within the bore, gas seal on the base due to shape, hardness of core material, etc.

If you change bullet brands in you load, once you determine the new bullets velocity is above or below the previously identified nodes, all that should be required to make it shoot at a greater performance is to adjust the powder charge so the velocity is within the range your barrel likes.

Standard Deviation (SD)

With many hand loaders and precision rifle shooters, we are always finding a way to lower our standard deviation (SD). Standard deviation, in statistics and the probability theory shows how much variation or dispersion exists from the average. A low standard deviation indicates that the data points tend to be very close to the mean" a high SD indicates that the data points are spread out over a large range of values.

Simply put, in regards to bullets, standard deviation is just a fancy way of averaging each points distance from the mean, or how spread out your bullets are. The higher the SD is, the more spread out your bullets data is, while a low SD means the bullets data is closer together.

For example, if you shoot a string of five rounds, and your highest muzzle velocity is 2900 fp/s, and your lowest muzzle velocity is 2800 fp/s, then the SD of your muzzle velocity is calculated by (2900 – 2800)/2.326 = 42.99 fp/s.

The number 2.326 is derived from the following:

Bullets used: Divide your range by this:
2 1.128

3 1.693
4 2.059
5 2.326
6 2.534
7 2.704

Standard deviation is nothing more than a glorified average of how far each point in your collection of data is from the mean of data.

Evaluate firearm accuracy based on many groups. Do not be distracted by changes in group size that are within plus or minus 50% of your firearm's long term average group size. Such variations are completely explainable by nothing but normal random variation, and do not indicate any change in the firearm, loads, or shooting technique.

The Conclusion of Standard Deviation

For samples as small as five or so, use range instead of standard deviation. For small samples, standard deviation will almost always underestimate variation. Base estimates of standard deviation on small samples only if you are content to have a large amount of uncertainty in your estimate. It takes a lot of data to precisely estimate a standard deviation.

Do not interpret small changes in variation as real change, unless you have the large sample size required to support such a conclusion.

Alternate Shooting Positions

As we are all very familiar and comfortable shooting and engaging targets while in the prone position, how familiar are we with shooting in alternate positions?

Whether we are shooting in the seated, kneeling, standing, or squatted position, we need to be just as familiar and comfortable in the alternates as we are in prone.

We often find ourselves only practicing what makes us feel good, or what we are good at when at the range. The problem with this is that if we only practice what we are good at, if or when the time arises where we may find ourselves in a situation where the only shot that can be taken is from an alternate position, the confidence needed will be nonexistent. We must have the accuracy and confidence in an alternate position as we do in the prone.

There are many situations where a shooter may find himself utilizing an alternate shooting position. My personal experiences while deployed

overseas to Iraq and Afghanistan, more than 75% of my engagements were non-prone. The prone shot is known as the rare shot in real world precision rifle engagements. We need to understand that in actual engagements, our targets may be obscured by tall grass, a street curb, etc., or we may find ourselves in urban or mountainous environments where a prone shot is nearly impossible.

The various alternate shooting positions that will be discussed in this chapter are the most commonly used by military, law enforcement, and precision rifle competitors. The shooting positions are:

- Kneeling sling supported
- Sitting
- Squatting
- Standing
- Freestyle

In order to properly discuss these topics, we need to understand a few fundamentals that will greatly affect the outcome of our shot downrange if not properly applied.

We all understand, or at least have a good grasp of the fundamentals applied to precision rifle shooting. While all the fundamentals are extremely important, some of them are not applicable in alternate positions, thus forcing us to give extreme attention to the remaining.

In an alternate position, one of the most common fundamentals that we will not be able to properly apply is "body alignment". Whereas in the prone position, we point the rifle to the target and our body to the rifle, while alleviating any angles by only introducing 90 degree angles to the gun to properly absorb recoil, in the alternate positions, this will not always be possible. Our greatest friend, in regards to alternate shooting fundamentals, will be our natural point of aim.

Typically in an alternate position, we tend to find ourselves uncomfortable and forcing the reticle on target (muscling the gun). As discussed in the Precision Rifle B.I.B.L.E Volume 1, we know that the microsecond before the rifle is fired, our body naturally goes into a state of relaxation, where the

muscles in our body completely relax. As the body naturally relaxes, if we are muscling the rifle on target, the sights will fall to where our body is “naturally relaxed”, this causing a miss.

If we have achieved a natural point of aim while in the alternate positions, as the body relaxes, the retile will remain on the target.

In order for us to achieve a good natural point of aim in the alternate shooting position, we must perform the same procedure as we would in the prone.

Many of us will find that the sights will wobble around the target, typically in a figure 8 motion. We want to make sure that we have the same amount of error on both sides of the target. If the reticle has more error off to one side of the target than the other, we need to make slight, micro adjustments so that the error is the equal amount on both sides of the target. As long as we have achieved a good natural point of aim, during the firing phase, the rifle reticle will naturally “snap” to the center of the target.

Another fundamental that we will see fall to way side will be our breathing. Being that we are in an alternate position, many precision shooters find that their diaphragm is constricted, resulting in shallow breaths, unlike when in the prone where we are able to take long deep breaths. In order for us to maintain our accuracy with these shallow breaths, we need to first not exacerbate the problem by holding our breath to achieve a stable platform. For some reason, I typically see that when in alternate positions, shooters have the tendency to hold the breath. Being that we already have a shallow intake of oxygen, in some cases depending on the position by 50%, we need to be able to utilize the amount that we do have, especially being that the first thing to go when lack of oxygen, is our eyes.

The Common Errors

Some of the common errors that I have seen the most are the following:

- Shooter confidence
- Anticipation
- N.P.A

- Breathing
- Improper utilization of sling and skeletal structures

Shooter Confidence

Shooter confidence will play a huge role in alternate positions. The mere lack of confidence can push a shot off target. Most, if not all of the shooters that I talk to, say that alternate positions are just too hard and uncomfortable, and that being the reason for not practicing them. My usual response to such a statement is, “how comfortable to you comb your hair with your right hand?” Typically the answer is, “perfect”. The reason for this statement is to exploit the fact that no one is born excelling in a certain task, you simply practice it over years and years until it becomes second nature. The same rule applies to alternate shooting positions.

The key to practicing alternate positions is not to use live rounds on the range. The best shooters in the world in fact do not shoot as many live rounds as they do dry fire. The key to confidence is practice through dry fire.

Anticipation

Anticipation is one of the most common errors that I see in precision shooters who shoot alternate. You can typically see the anticipation before the shot even breaks. Once again, a lack of confidence and dry fire can be the result of anticipation.

I stress dry fire because it’s scientifically proven that it does work. If we train our brains that when the trigger is squeezed to the rear, and only the click of the rifle is heard (through dry fire) with the reticle remaining on the target without any lateral or horizontal shift, we can rule out shooter anticipation when a live round is fired.

N.P.A

If we ignore our natural point of aim during an alternate position, we will experience one of two, or an accumulative of two results.

The shooter will either experience a miss, due to muscling the rifle on target, or not able to reacquire the target after the shot is fired.

When the shot is fired, if the rifle rises straight up and then back down to its point of origin, the shooter has a good N.P.A.

Breathing

Once again, if we hold our breath while in an alternate shooting position when our diaphragm may also be compressed, reducing oxygen an additional 30%, we are only exacerbating a problem.

Always remember that the first thing that is compromised while shooting and holding your breath is the eyes. The eyes will begin to flutter, shift, and tunnel vision will begin if taken to its extreme (more than 5 seconds).

The flutter in the eyes is then transferred to the facial bone structure, which is then transferred to the rifle.

The shooter will also experience the rifle begin to jump with the rhythm of the heart if the breath is held. Being that the lungs are similar to balloons, when fully inflated and the heart located in-between the two, the "thump" of the heart will be felt greater than that of lungs that have less or no air in them.

Improper Utilization of Sling and Skeletal Structures

When the proper form is achieved when in the alternate shooting position, the shooter will note that the rifle is not being held in place by influence of the muscles, but instead the sling and skeletal frame. This will be discussed in greater detail in the "Kneeling Sling Supported" section.

Kneeling Sling Supported

The kneeling sling supported position is a very stable platform to shoot from, but also has its drawbacks.

The main drawback of this position is "time". The time that it takes the shooter to get into this position properly, can take up valuable time, and may not be suitable for some shooters in the tactical community when every second counts, especially on a two way range.

Here are the steps to get into the kneeling sling supported position:

1) Attach the sling to bottom sling swivels of the rifle and get into the seated position (the seated position will be discussed in its entirety in the “kneeling position section).

2) Once in the seated position, place the butt of the rifle on the hip, with the ejection port or the opening of the bolt facing forward. The muzzle of the rifle should be upward towards the sky in a manner not to flag anyone or anything.

3) The shooter will then take the short end of the sling and give it a quarter turn outward/away from you.

4) The shooter then passes his support arm through the loop and places it high on the bicep.
5) While maintaining muzzle awareness, the shooter then tightens the loop around the bicep. The tension of the loop should be to a point as to where it almost is “too tight”, but not to completely cut off circulation.

6) The shooter will then place the support hand on the forearm of the stock with the sling running smoothly across the back of the hand and across the wrist.

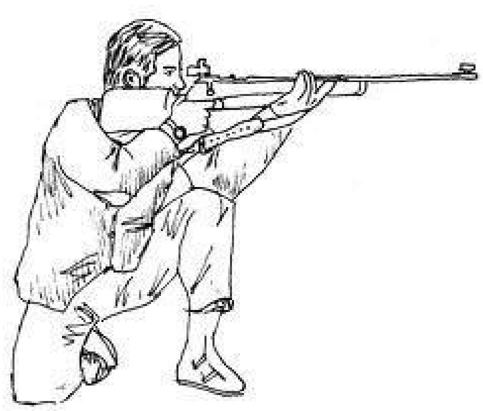
7) If the sling is too tight, you will not be able to get the stock in the pocket of your shoulder without great discomfort. If the sling is too loose, it will feel as if there is hardly any tension on the sling at all.

8) The support hand is to be used simply as a rest, not a grip. Keep the support hand loose, avoiding grasping the rifle forearm.

The long end of the sling will serve no purpose at all and can be disconnected.

The proper Kneeling position (No Sling)

This position can be used when terrain or vegetation will obscure the shooters sights or target.
Features of a successful kneeling position are the following:

 (Picture also displays the utilization of the sling.)

1) The foot under the shooters buttocks. If the shooter cannot achieve this position, he may place a shooting pad inbetween the foot and buttocks. Try to avoid sitting on the foot when the heel and toes are vertical, this creates a pivot point.

2) Allow almost all of the weight of the shooters body to rest on the heel.

3) The shooters torso is fairly erect, but the shoulders are rolled forward. The shoulders are however, not erect, and instead are rolled forward or slumped down.

4) The support hand location is not to grasp the rifle stock, it is far enough back on the fore end to place the rifle fairly high in the shoulder and keep the head erect. The sling will support the weight of the rifle.
5) The body is turned 30-45 degrees away from the target, but

6) The N.P.A should be taken over precedence of the example of 30-45 degrees.

7) The tricep of the support arm should rest just over the kneecap. The bone of the elbow should not rest on kneecap. If the shooter were to look down over the rifle, he should see that the support arm is directly under the rifle. This ensures that the shooter is using the skeletal frame to support the rifle, and not the shooters support arm. If the rifle is not lying directly over the support arm, the bicep muscles are being used, and will result in muscle fatigue and trembling over a period of time.

8) The left lower leg that supports the support arm, is vertical. Elevation in the reticle can be achieved by slightly moving this leg forward or backward.

9) The firing arm and hand will not grasp the rifle, and the shooter will still be able to achieve a 90 degree trigger squeeze straight back to the rear.

Sitting

The sitting position is also suitable for shooters when vegetation or other obstacles lay in-between the shooter and target. This position may also be used with the sling as well.

There are three variations of the sitting position, ankles crossed, legs crossed, and the open legs position.

We will be discussing the open legs sitting position, the remaining variations are based off of this position. Here is how to properly achieve this position:

1) While sitting on the ground, the shooter will bend his knees 90 degrees and place the feet roughly shoulder width apart.

2) Place the elbows inside and just forward of the knees. 3) Be sure to relax the muscles and let the legs take up the weight of the rifle.
4) To adjust for elevation, the shooter can slightly move the feet closer or further away from the buttocks.

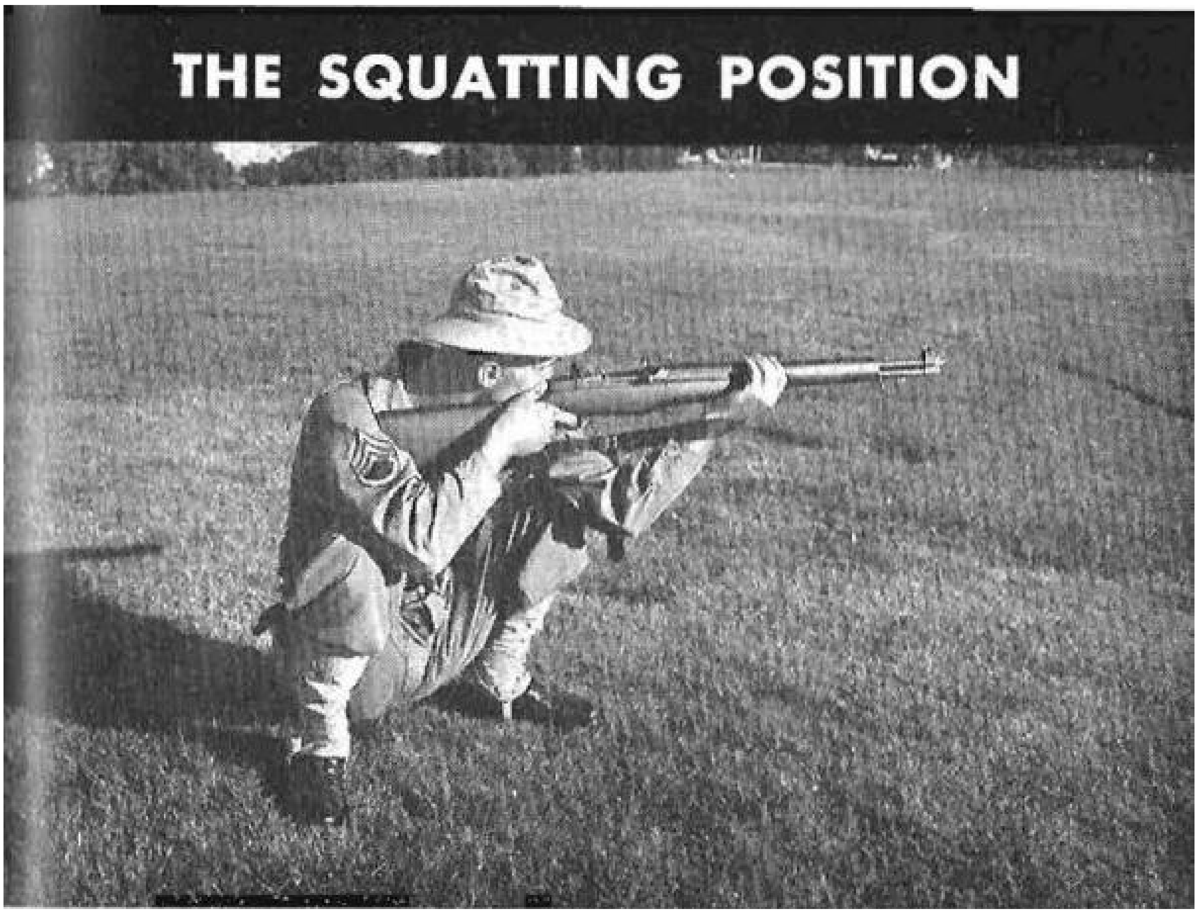
While in this position the shooter must be aware of NPA. The scope reticle should lie naturally on the target without muscling the rifle. If the shooter finds himself muscling the rifle, he can move his body in slight increments left or right using the feet until NPA is achieved.

Squatting

The squatting position is also referred to as the “rice paddy” squat, in reference to the shooting position used by the Vietcong in the Vietnam War.

You will find that not only is this position very stable, but easy to get in and out of in a timely fashion.

The squatting position is achieved by the shooter simply lowering his buttocks between feet, hence squatting. The support elbow/tricep is placed over the left knee, and the firing elbow is placed on the inside of the right knee or thigh. The shooter should still keep in mind that the support elbow lies directly beneath the rifle to prevent muscling.



Standing

The standing position is one of the most demanding of the shooting positions. It places a far greater pressure on the shooters ability to keep the sights on target in order to release a good shot. This position is extremely difficult when the weather conditions and the ground contours are not favorable.

This position uses more muscles to keep the body in place, these muscles in turn need to be controlled and conditioned. The best way to master this position or at least be comfortable with it, is to practice the position as

technically perfect as possible and then, modify the position to suit your own body.

The technical perfect standing position is described as:

1) The shooters body should face 90 degrees to the target (with front of your body being 0 degrees and left portion of your body representing 270 degrees).

2) The feet are placed slightly greater that shoulder width apart. The left foot may be turned outwards.
3) The legs are straight but relaxed, with the left hip angled upward.

4) With the rifle held in place, butt stock firmly in the firing shoulder pocket, the support hand rests along the bottom of the forearm of the rifle stock, close to the trigger guard.

5) The firing elbow should rest on the hip of the left leg. If this cannot be achieved, the shooter may place a rear bag, or cushion between the support elbow and hip area.

6) 60-80% of the shooters weight should rest on the front foot.
7) The support elbow should remain under the stock of the rifle.

(Photo above of Tim Milkovich utilizing the sling and shooting glove in the standing position.)

(Note how the rifle lays directly over the shooters support elbow)

Freestyle Positions

The majority of targets on the Field Target course can be taken freestyle, which as the name suggests, is any position off the competitors choosing. While there are people who have gained some success from other positions, the most prominent position for the freestyle, is the sitting position. This position started life in the early eighties and is an amalgam of other previous sitting positions used in other disciplines tailored to the special requirements of the air rifle. The advantages of this position are its stability, ease of use, relative comfort and sufficient ground clearance.

One of the most popular freestyle shooting positions is pictured in fig. 3.2 and fig. 3.3.
The position is constructed as follows.

1) The majority of the weight is taken by the shooters buttocks or a cushion to sit on, which is a strong waterproof bag part filled with a supportive material (such as polystyrene balls) to a maximum height of 4 inches.

2) The knees are drawn up towards the chest and the rifle supported over the left knee in some way, in the case of the picture by the left elbow.

3) Better stability is achieved if the feet are in full contact with the floor, but they must do so naturally and not be forced downward. Adjusting the height of the cushion may facilitate this.

4) The right hand takes up the grip but does not steer the rifle and the right knee supports the right elbow.

5) The left hand may rest on the right forearm or wherever is convenient so that muscular tension is minimized.

7) The back is allowed to form a natural arch so that tension in the postural muscles is minimized. It must be noted that the various lengths of an individual's limbs and body will have a great effect on the outward appearance of the position, as they are all interrelated. In all cases the shoulders must be maintained in the same plane as the pelvis when looking from above. If this is not achieved side-to-side movement will result. To facilitate this it is best to use this as the starting point when constructing the position from the outset to ensure a good foundation for development.

Fig. 3.2 (Carlos Hatcock)

Fig.3.3

Negative Leads

A negative lead is typically used when engaging a stagnant target while the shooter is moving. A negative lead can also be used on a moving target.

Negative leads are typically seen in high wind velocities and the target speed is relatively slow.

Let’s use a 175 grain .308 HPBT bullet, with a velocity of 2650 fps, a wind velocity of 10 MPH at a 270 degree angle, and a distance of 400 yards for the example to follow.

With the information provided above, in order to hit a stagnant target at this distance, we know that we will need a wind hold of approximately .91 MILs in the direction of the wind. If the target is moving at a speed of 4 MPH with no wind, the lead will be around 2.4 MILs. If the 4MPH target is moving with the direction 10 MPH wind (left to right), we will need a lead of 1.7 MILs, opposed to the -3.5 MILs if the target was moving right to left. The reason for the drastic MIL hold is due to the fact that we are not only fighting the wind velocity, but the lead as well (when the target is moving into the direction of the wind.).

A wind velocity of 20 MPH moving the same direction of the target at 270 degrees, we will need a lead of only 0.8 MILs. The lead value decreases because we are using the velocity of the wind to help “push the bullet” into the moving target. The lead value drastically decreases when the winds velocity exceeds 30 MPH. A target speed of 4MPH, moving left to right, with a wind velocity of 30 MPH at a 270 degree angle in relation to the shooter, we can expect a hold of around -0.1 MILs. A target that is moving at a slow walking pace with the direction of the wind, around 2 MPH, the lead hold would be -1.4 MILs.

Although the wind speeds may be extreme to some, note that the target speed is 4 MPH, a relatively fast walk, and that the distance to the target is a mere 400 yards. For the extreme precision shooter, we may encounter moving targets at ranges of 600-700 yards.

Using a slow walking pace of 2.5 MPH, moving with the direction of a left to right 25 MPH wind, at a range of 700 yards, our lead would equate to -2.7 MILs. Decreasing the wind velocity to a mere 15 MPH, we will need a lead of -0.9 MILs.

A rule of thumb, with most .308 loads, the following formula will work for targets at a distance of 500 yards or less, moving at right angles to the line of fire:

LEAD IN MILs = Target Speed (MPH) * 0.6
Typical Human/Target Speeds

Slow patrol = 0.8 mph Fast patrol = 1.3 mph Slow walk = 2.5 mph Fast walk = 3.7 mph Jogging = 6 mph Fast run = 11 mph

Taking the average speeds of human/target speeds on an average walk or stroll, the negative leads may not be as great. But as a sniper/precision shooter, we know that shots in wind, on a moving target is often a miss on the first shot, and after the target knows that it is being engaged, it will begin to run or jog.

Looking at several data charts and mathematical target lead tables of several bullets, I have seen that a “negative lead” will greatly apply at wind velocities exceeding 30 MPH when the target is moving at a slow to fast walk, and also with a wind velocity of 10 MPH and the target speeds are at a slow patrol.

The shooter should also be aware of “time considerations” when engaging moving targets. The bullet does not leave the barrel as soon as the sear releases, rather there is a delay between the release of the sear and the bullet exiting the barrel. During this time any movement can move the firearm off target, and so this time should be minimized, especially for firearms that will be fired from an unsupported standing position. This delay can be broken down into three sections, the lock time, bullet dwell time, and shooter reaction time.

These time considerations are extremely important to the shooter engaging moving targets using formulas or ballistic calculators. Formulas and

ballistic calculators do not account for time considerations, but instead are only true/correct when the bullet clears the tip of the muzzle.

Lock Time

Lock time is the time between the release of the sear, and the ignition of the cartridge. A lengthy lock time gives time for the shooter to drift off target, and so it is advantageous to minimize the lock time, and reduce the window for error. Reductions in lock time are generally performed by lightening parts that move as part of the firing operation, such as the hammer and firing pin or striker, and using a more powerful spring. Further reductions in lock time, to near zero levels, can be achieved with electrical primers.

Dwell Time (in regards to the bullet)

The bullet dwell time is the time between cartridge ignition, and the time the bullet leaves the barrel. Like lock time, dwell time is a window for error, and can be minimized with a faster bullet or a shorter barrel. In some cases a shorter barrel is desired to reduce dwell time, but without losing the sight radius of a longer barrel. In this case a sight extension tube, or bloop tube can be used. This is a tube that fits on the muzzle end of the barrel, providing support for the front sight, but that is bored to much larger than bore diameter. This provides the sight plane of a long barrel with less weight and dwell time.

Shooter Reaction Time

The time that it takes the shooter to visually see the target intersect the desired hold in the reticle, and the time it takes the shooter to fire, is shooter time. Some shooters may perceive things differently or may have faster reaction time than others. This variance in reaction time can be seen greatly in the elder and younger shooters. Typically the younger shooter will have less shooter reaction time than the elder shooter.

In Depth Look at Spin Drift/Coriolis/Magnus

This chapter discusses a long ongoing topic in the precision rifle and sniper community. Some shooters argue that these external ballistics (spin drift, Coriolis, and Magnus) have no effect, some effect, does not exist, etc., no matter the case, the effects do have an influence on the trajectory in a predictable manner as it travels downrange. In order to properly answer any questions in regards to these ballistics, we first need to fully understand what they truly are before moving any further as to what effect they have on long range shooting.

Spin Drift

Spin drift/gyroscopic drift, is described as a projectile moving along the horizontal plane with no sideways air movement induced as it travels to the target. Spin drift has absolutely nothing to do with any wind or atmospheric conditions. Spin drift is a gyroscopic effect related to the rotation of the bullet and will occur in a vacuum. Precession is the force that is applied to the outer edge of the spinning object, this being the bullet, and results in deflection. The deflection will be 90 degrees from the point of pressure and in the direction of the rotation. Precession is a change in the orientation of the rotational axis of a rotating body. It is a change in direction of the rotation axis of the bullet.

The type of precession/spin drift we are referring to is a torque induced drift, or a torque induced precession. This is the phenomenon in which the axis of a spinning object will wobble when torque is applied to it which will cause a distribution of force around the acted axis. All rotating objects can experience this effect, commonly seen on a top toy. When a bullet is moving through the air and is rotating to the right, the bullet’s axis of symmetry points to the direction of the rifle twist and in an upward fashion with respect to the direction of its velocity vector. For example, a bullet fired from a rifle that has a right hand twist, meaning the rifling in the barrel forces the bullet to spin/rotate to the right, and thus causing the bullets spin drift to the right of the intended target and vice versa for a left handed twist.

Knowing the theory of spin drift, at what magnitude does it affect our bullet as it is traveling to the target?
There are three key factors that will determine the magnitude of how much spin drift will affect us. These three factors being:

- Projectile or bullet length: A long projectile will experience more spin drift due to the fact that they produce a more lateral "lift" for a given yaw angle.

- Range, trajectory height, and time of flight: Spin drift will increase with all of these factors.
- The projectiles spin rate: Bullets that spin at a faster

rate, it will produce a greater spin drift due to the fact that the nose ends up pointing farther to the side.

The Facts

Knowing that spin drift does in fact exist, exactly how much will our bullet deviate off its course and where does it take place along its trajectory? Some shooters argue that spin drift is as much as 25 inches at 1000 yards, some as little as 12 inches, and some argue that you shouldn't worry about it.

Spin drift has been measured using a Doppler radar system for several US military and various very low drag conventional bullets at 1000 yards. The results that Doppler radar shows us is that for a US military M193 Ball, 55 grain bullet with a diameter of .223 in/5.56 mm, has a spin drift of 22.75 inches at 1000 yards. The magnitude of the spin drift is greatly due to the bullets time of flight, velocity well below the speed of sound (approx. 1129 fps), and its trajectory in height. When the test is performed on the higher caliber bullets such as the 190 grain LRBT J40 Match .308, we only see a spin drift of 3 inches at 1000 yards, and the popular extreme long range precision cartridge, the 419 grain LRBT J40 Match .408, there is a negligible spin drift of only 1.88 inches.
Below are various rounds of recorded spin drift at 1000 yards:

M118 Special Ball, 173gr., .308 = 11 inches of spin drift
Palma Sierra MatchKing, 155gr, .308 = 12 inches of spin drift

Sierra MatchKing, 220gr, .308 = 7.5 inches of spin drift
LRBT J40 Match, 350gr, .375 = 0.87 inches of spin drift
Sierra MatchKing, 300gr, .338 = 6 inches of spin drift
LRBT J40 Match, 190gr, .308 = 3.00 inches of spin drift

When looking at the variances of spin drift above, we must not a few key things. The first being that with the multiple variances, spin drift is rather variable with no clear trend that is easily distinguished. The second being that by looking at the deviation off target in the horizontal plane would require that there is absolutely NO WIND throughout the entire path of the bullet over the course of 1000 yards. In order for us to determine that there is no winds throughout the bullets travel, we need to have wind readings entirely from our position to the target, and the bullets trajectory which includes its path to max ordinance and descent to target. If there is any wind on the bullets path to target, we would have to measure it within the .3 – 1mph range (a 1 mph wind will push a 175 gr. .308 bullet along the horizontal plane 10 inches at 1000 yards), which in my opinion is nearly impossible utilizing the tools we have available to the average precision shooter.

The next question in regards to spin drift, is where does spin drift occur and how much to apply on the scope to counter the drift. Some may argue that it takes place at 300 yards and .5 MOA, while some say it occurs anywhere in-between 500 and 650 yards and adding 1-3 MOA. If this is the case, and the arguments do stand to be solid, there are something’s that we cannot dispute, and this being fact, science (physics), and math.

Seeing that Doppler has measured the effects of projectile spin drift, we now have a base in which we can now apply math. For those arguing spin drift being a .5 MOA at 300 yards for a .308 190gr., how would this look mathematically? We know that the spin drift for this bullet at 1000 yards is 3.00 inches, and that spin drift is due to three key factors, with emphasis on time of flight, trajectory, and range, if the spin drift in argument is .5 MOA at 300 yards which is 1.5 inches, how could this be possible. The flight time of the .308 190gr at 1000 yards is approximately 1.5 seconds and the time of flight at 300 yards is approximately 0.35 seconds. If indeed the bullets spin drift is 1.5 inches at 300 yards in the duration of 0.35 seconds, then in

order for it to achieve the known spin drift of 3.00 inches at 1000 yards, the bullet would have to at some point in its time of flight, maintain or increase its velocity for a period of time, or stabilize for a short period of time in order to achieve the additional 1.5 inches over the range of 700 yards. As we know, this simply cannot be accomplished. The same rule will also apply for the remaining ranges in argument.

The fact of the matter is that as little effect that spin drift has on our projectile at 1000 yards in comparison to the other environmentals that we must account for, I argue that unless you are shooting in perfect conditions (no wind through the bullets trajectory), you can account for the 3.00 inches of spin drift, which would be less than 1/10 of a MIL (1/10 of a MIL at 1000 yards equals 3.6 inches) in which to my knowledge, scopes don't dial less than 1/10th. With the data described above, we can also note that the most the shooter will have to dial for spin drift is in-between .3 and .4 MIL.

Coriolis Drift

I'm sure we've all seen or heard of the Coriolis effect in Hollywood films, ballistic calculators, or from other precision rifle shooters on the range and how much it affects the bullet flying downrange. When hearing or talking about this effect amongst friends, how often do we come to a conclusion as to how much this effect will deviate our bullet while in flight? The effect does in fact exist, and can be mathematically computed and seen, but the question we need to answer is, "how much do I really need to account for, and is negligible?"

Coriolis drift is caused by the Coriolis Effect and the Eötvös effect. These effects cause drift related to the spin of the Earth, known as Coriolis drift. This drift can be up, down, left or right. Coriolis drift in not an aerodynamic effect; it is a consequence of the bullet flying from one point to another across the surface of the rotating Earth.

The direction of Coriolis drift depends on the firer's and target's location or latitude on Earth, and the azimuth of firing. The magnitude of the drift depends on four factors, shooter location, the target location, azimuth, and time of flight.

During a bullets flight to the target, the bullet moves in a straight line (not taking environmentals into consideration). Since the target is co-rotating with the Earth, it is in fact a moving target, relative to the projectile, thus in order to hit our target, we must actually aim at a point in space where the projectile and target will arrive simultaneously. For an observer with his frame of reference in the northern hemisphere, Coriolis makes the bullet appear to curve over to the right. In reality, it is not the projectile curving to the right but in fact it is the Earth rotating to the left which produces this result. The opposite will seem to happen in the southern hemisphere. The Coriolis Effect is at its maximum at the poles and negligible at the equator of the earth.

For small arms (precision rifle shooters), the Coriolis effect is generally insignificant, but rather reserved and acknowledged for projectiles that travel with long flight times, such as artillery, ICBM's, and in some cases extreme long range rifle precision (1700 yards and beyond).

For those in disagreements that it is not negligible at our precision rifle shooting distances, 1000 – 1100 yards, let's take a look at the math.
Horizontal Deflection (Coriolis Drift) =

$(\Omega\ x^2 \sin (L)/V$

Ω is the earth's rotation rate and is 0.00007292 X is the range in feet
L is the latitude (Degrees from equator)
V is the average velocity (Distance in feet ÷ time of flight)

For example:
If your bullets time of flight to 1000 yards is 1.40 seconds, then V = 3000ft./1.40 = 2143 ft/s
Coriolis Drift = $(0.00007292 \times 3000^2 \times \sin (45)/2143 = 0.21$ feet or 2.5 inches!

Noting that the Coriolis drift will only impact 2.5 inches left or right depending where you are on the hemisphere, let's take a look at what the drift will look like at 1800 yards for the extreme precision shooters.

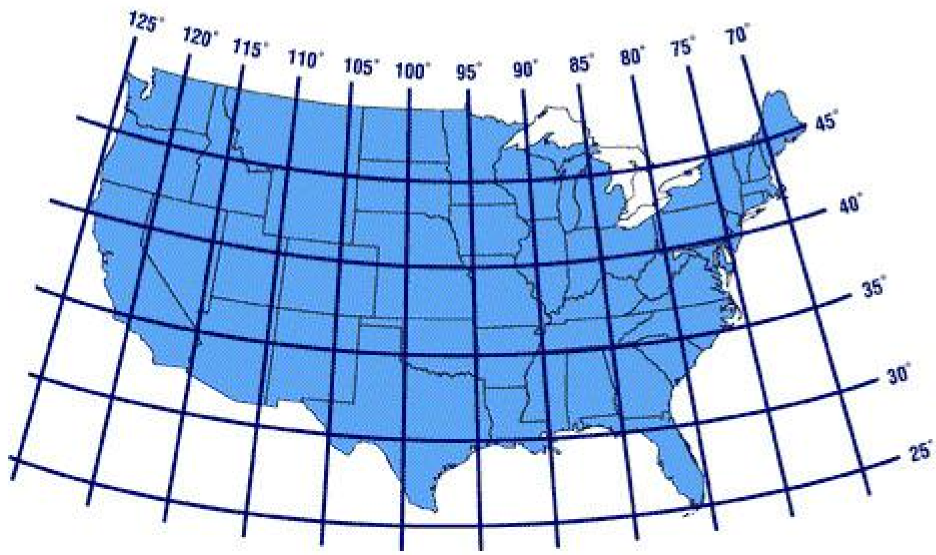
Time of flight for the round used is 3.74
Coriolis Drift = (0.00007292 x 5400^2 x sin (45)/1444 = 1.03 feet or 12.27 inches!

And once more for the 2000 yard shot with a bullet flight time of 4.4 seconds
Coriolis Drift = (0.00007292 x 6000^2 x sin (45)/1363 = 1.34 feet or 16 inches!

With the data that we have listed above, we can see how negligible the Coriolis effect/drift can be for the typical ranges that we shoot. Looking at the mere fact that at 1000 yards, our scopes windage turret could not dial in 2.5 inches. Taking note that in the most perfect condition with no wind, the average precision rifle target size at 1000 yards is 10 inches wide, if we neglected to dial for Coriolis drift and held dead center mass, our bullet would impact 2 inches from the edge of the target, a perfectly great hit. For the shooters that shoot human type targets is size (20 inches in width), even for the 1800 yard shot in a perfect world, the bullet would impact 2.27 of to the left or the right, so the shooter would simply have to hold or favor one side of the target depending on the shooters geological location.

Please note that the drift is always to the right in the northern hemisphere, and left in the south and is independent of the azimuth.

The Coriolis Drift in the US



Looking at the picture of the United States, we can see both the Longitude and Latitude degrees. The formulas that were previously discussed, used a latitude of 45 degrees from the
equator.

The data below will give you the Coriolis drift from a 25 to 40 degree latitude perspective.

25 degrees = Coriolis Drift of 0.13 feet or 1.5 inches
30 degrees = Coriolis Drift of 0.155 feet or 1.8 inches
35 degrees = Coriolis Drift of 0.178 feet or 2.1 inches
40 degrees = Coriolis Drift of 0.199 inches or 2.4 inches

Some of the top precision shooters go to shoot and compete in Southern Texas, not only because of the challenging winds, but also for the extreme ranges and courses of fire. For those that are shooting in this location, such as myself, expect an amazing amount of Coriolis Drift to be around 1.6 to 1.8 inches to the right, an amount that we cannot dial for.

Magnus Effect

All spin stabilized projectiles are affected by what is known as the Magnus Effect. The Magnus effect is where the spin of the bullet creates a forces acting upon it either up or down, perpendicular to the sideways vector of the wind. For example, a horizontal wind, and a right hand rotation of the bullet, the Magnus effect induces pressure differences around the bullet causes a downward (wind from the right) or upward (wind from the left) force viewed from the point of firing to act on the bullet, thus overall effecting its point of impact. The vertical deflection value tends to be small in comparison with the wind moving along the horizontal plane, although it can be significant in winds that exceed 9 mph.

The Magnus effect plays a significant role in bullet stability due to the fact that the Magnus effect does not act upon the bullet's center of gravity, but rather the center of pressure affecting the yaw of the bullet as it travels to its target. This effect will act as a destabilizing force on any bullet with the center of pressure located ahead of the center of gravity, while contrariwise acting as a stabilizing force on a bullet with the center of pressure located behind the center of gravity. The location of the center of pressure depends on the flow field structure, or in simplified terms, depending on whether the bullet is in supersonic, transonic or subsonic flight. This simply means that the shape and various other attributes of the bullet, in any case the Magnus effect force greatly affects the stability because it tries to twist the bullet along its flight to target.

Very low drag bullets, due to their length, have a tendency to show greater Magnus destabilizing errors due to the fact that they have a greater surface area to present the oncoming air they are traveling through, thus reducing the bullets aerodynamic efficiency. This very effect is one of the reasons why a calculated Cd or BC based on shape and sectional density is of a very limited use.

The Problem using Spin Drift and Coriolis Drift Apps

There are a ton of apps that shooters may use to calculate spin drift and Coriolis drift. Some shooters say that they absolute need it and that it increases their hit rate. I personally believe that these apps are simply a basic starting point to somewhat understand the effects, and not an end all be all firing solution.

Using the top of the line ballistic app available to the average shooter, I applied the Coriolis and spin drift effect to see the shifts in impacts caused by the effects. I input the following data:

Bullet type: Sierra 175gr. HPBT .308
Coefficient: G7
Velocity: 2650
Zero Distance: 100 yards
Sight Height: 1.5 inches
Barrel Length: 24 inches
Rifle twist rate: 1:12
Angle to Target: 0
Max Range: 2000 yards
Step Size: 50 Yards
Latitude: 30 degrees
Longitude: 100 degrees
Wind Velocity: 0
Wind Angle: 0
Altitude: 938
Temperature: 53 degrees Fahrenheit
Baro. Pressure: 29.87
Humidity: 96.5

Using the following data above, the ballistic app gives me a spin drift and Coriolis drift of 11.4 inches, and a bullet flight time of 1.7 seconds to target at 1000 yards. Looking at the drift at a range of 50 yards, my drift is .05 inches. I then changed the step size to range increments of 25 yards. My new drift at 50 yards is .065.

I then changed my zero range to a range of 300 yards to see what my spin drift will be. My drift at 50 yards is now 0.73 inches, and my 1000 yard drift equates to 10.8. The 100 yard drift is .67 inches. As we know, in order to change the zero on the rifle, we simply reach up and dial it on the scope, that will be our knew zero. If my 100 yard zero was true when I had the elevation set to my 100 yard DOPE, then why will I know have a .67 inch shift to the right of desired impact?

For those of us who successfully knock the center out of a 1 inch pasty at 100 yards, and then transition to a 300 yard, 3 inch pasty and produce less than 3 inch group's center of target, we know that spin drift nor Coriolis drift matters/exists, simply because the distance is so short. Anything less than 100 yards, we can stack bullets on top of each other center of target. By looking at the data from the ballistic app, it says that our drift will be close to an inch (0.73 inches) if we transition from the 300 yard zero.

We all know that this information is not correct. The problem/issue lays here. Once we dial up our elevation for the "new zero", we have successfully taken out the drift effects in theory, hence the reason why we are able to hit small targets at distance. If we zero our rifle at 100 yards, dial up to a 300 yard target (300 yard zero/DOPE), and then hold under to engage the 100 yard target, we will see absolutely no Drift!

The drift effects are so minimal, and the ballistics apps are merely a computer that uses an algorithm to solve the ballistic problems, it will put out information that does not hold to be fact on the range. The apps, as said before are only a starting point to understand what these effects can do to the rife bullet as it travels over great distances.

In a Perfect World

When looking at these effects, we can see that they do can present somewhat of an issue when taken to its extreme and absolute precision is necessary. Even though I believe that the shift in impact is so slight, in regards to other environmentals that need to be taken into account and will have a greater effect on the bullet, such as wind, what if we were shooting in absolute perfect shooting conditions?

Let's say that we as precision shooters had an absolute perfect day for shooting long range. In regards to Coriolis, Spin Drift, and Magnus, what shift in horizontal would we see downrange?

Taking a look at the date and formulas above, we can see that a 1,000 yards our Coriolis Drift would be 2.5 inches. With spin drift added to this, our shift would increase an additional 7.5 inches using the Sierra MatchKing .308 220 grain. This gives us a total of 7.5 + 2.5 = 10 inches of drift.

This 10 inches of drift, can also be seen as a 1 mph wind of full value.

When this is taken to its extreme using the M118 LR special ball ammunition, with a known spin drift of 11 inches, taking the effect of Coriolis of 2.5 inches, we arrive at a total of 13.5 inches of horizontal drift. The 13.5 inches of drift is also equivalent to a wind less than 2 mph (1.3 – 1.5 mph).

If this is the case and the shooter is in a perfect world where wind and other environmentals would normally take precedence over spin drift, Coriolis, etc., then the shooter would simply dial at the least .3 (10.8 inches at 1000 yards), and at its most .4 MILs (14.4 inches at 1000 yards). Regardless of the fact, the amount that we decide to dial on the scope, will still not be able to achieve the exact desired correction. What our scopes windage turrets are able to dial, will still over or undershoot the account for spin drift and Coriolis drift.

Semi-Auto vs. Bolt Action

There is an ongoing topic as to whether someone should purchase a semi-automatic precision rifle, or a bolt action, and why. There are a few key variances in both which make them very different. One may present itself harder to shoot or less accurate, while the other may be held on a pedestal.

Typically the bolt action precision rifle presents itself as being the most accurate in comparison to a semi-automatic. However, this depends on numerous other factors with regard to both firearm and ammunition, and modern semi-automatic rifles can be exceptionally accurate when designed as such. Some of the factors that precision shooters take into consideration when accuracy is discussed between the two platforms are:

- Recoil
- Gas release
- Moving components

Recoil

The bolt action rifle when fired, has only one recoil, this being recoil to the rear into the shooters shoulder pocket. The semi-auto precision rifle when fired, has three recoils, one recoil being to the rear as the bullet exits the muzzle, another recoil to the rear as the bolt slams into the buffer, and the final recoil as the bolt slams forward picking up an additional cartridge.

The bolt rifle only having a single recoil to the rear, in some cases allows the shooter to “drive the rifle” in a superior manner.

Gas Release

When a cartridge is fired inside the chamber of a bolt action rifle, the force from the burning charge and expanding gases is directed at propelling the bullet down the barrel, however, some of the energy is transferred to the shooter through its normal recoil. Unlike the semi-automatic rifle, some of the energy used to propel the bullet down the barrel is used to cycle the action.

Moving Components

The moving components within the two rifle platforms may also present one to be superior to another. Typically precision rifle shooters prefer the bolt rifle simply due to its lack of moving components. Taking a look at the bolt rifle, the only moving part is the bolt, which is manually operated by the shooter. Once the bolt is locked, the entire rifle is merely one solid component, thus making it easier to control through recoil, and avoiding bullet impact deviation downrange due to shooter induced movement of a moving part on the rifle.

The semi-automatic precision rifle will always have a moving part at some section on the rifle, usually this being the upper and lower receiver. If you've ever looked through the scope while in the prone position, the slightest movement with your firing or support hand, you can notice that the upper receiver will slightly shift left or right, or in some cases, up or down. This slight shift/movement within the scope may be caused by a number of reasons, shooter flinch, undue sympathetic squeeze as rifle is firing, etc. As the shooter begins to fire or begins to perceive recoil, the shooter may cause the upper and lower receiver to shift where the two components meet, thus causing a change in desired point of impact when the rifle is fired. To the untrained or novice shooter, it may appear as a "sloppy gun", or a rifle that is unable to achieve 1MOA.

A Look at Malfunctions

Semi-Automatic

As with any semi-automatic rifle or handgun, we can find an array of weapon induced or shooter induced malfunctions. Some of these malfunctions that I have seen common within the semi-automatic family of precision rifles include the following:

- Stovepipe: A stovepipe occurs when the casing that has been ejected is caught in the ejection port by the slide. This may be the case of many factors. Some of the most common are unburned powder in the cartridge, obstructions of various sorts

that are placed near the ejection port not allowing the complete ejection of the spent casing, and poor ammo.

- Failure to Extract: This results when the cartridge case remains in the chamber of the rifle. While the bolt and bolt carrier could move rearward only a short distance, more commonly the bolt and bolt carrier recoil fully to the rear, leaving the cartridge case in the chamber. A live round is then forced into the base of the cartridge case as the bolt returns in the next feed cycle. This malfunction is also one of the hardest to clear. The following could be the result of a failure to extract:

1. Short recoil cycles and fouled or corroded rifle chambers are the most common causes of failures to extract. A damaged extractor or a weak or broken extractor spring can also cause this malfunction.

- Failure to Eject: A malfunction occurs when the cartridge is not ejected through the ejection port and either remains partly in the chamber or becomes jammed in the upper receiver as the bolt closes. When the firer initially clears the rifle, the cartridge could strike an inside surface of the receiver and bounce back into the path of the bolt. A cause for the failure to eject could be a result of carbon or fouling on the ejector spring or extractor, or from short recoil. Short recoil is usually due to a buildup of fouling in the carrier mechanism or gas tube, which could result in many failures to include a failure to eject. Resistance caused by a carbon-coated or corroded chamber can impede the extraction, and then the ejection of a cartridge.

- Double Feed: This malfunction occurs when a round is in the chamber and a second round attempts to feed into the chamber. This results in a true jam. On most of the semiautomatic weapons, the slide has a limited motion and the magazine will not eject by pressing the magazine release.

- Failure to Feed, Chamber, or Lock: A malfunction can occur when loading the rifle or during the cycle of operation. Once the magazine has been loaded into the rifle, the forward movement of the bolt carrier group could lack enough force (generated by the expansion of the action spring) to feed, chamber, or lock the bolt. Some of the causes could be the result of the following.

1. Excess accumulation of dirt or fouling in and around the bolt and bolt carrier.

2. Defective magazine (dented, bulged, or a weak magazine spring).
3. Improperly loaded magazine.

4. Defective round (projectile forced back into the cartridge case, which could result in a stubbed round or the base of the previous cartridge could be separated, leaving the remainder in the chamber).

5. Damaged or broken action spring.
6. Exterior accumulation of dirt in the lower receiver extension.

7. Fouled gas tube resulting in short recoil.
8. A magazine resting on the ground or pushed forward could cause an improper lock.

- Failure to Fire: A failure of a cartridge to fire despite the fact that a round has been chambered, the trigger pulled, and the sear released the hammer. This occurs when the firing pin fails to strike the primer with enough force or when the ammunition is defective. Probable causes of this malfunction could be due to excessive carbon buildup on the firing pin because the full forward travel of the pin in restricted. A defective or worn firing pin can also give the same results. Proper inspection of the ammunition could reveal a shallow indentation or no mark on the primer, indicating a firing pin malfunction. Cartridges that to show indentation on the primer, but did not fire also may indicate faulty ammunition.

Bolt Action Rifles

The benefit of having a bolt action rifle, is the lack of malfunctions they produce. Here are a some of the most common bolt action malfunctions that I have seen over time, both shooter induced and weapon induced.

- Falling Firing Pin: A falling firing pin occurs while the shooter closes the bolt too fast or too hard. The firing pin will not stay in the rear position but instead “fall forward” and move into the fired position. When this occurs, the shooter is not able to fire the rifle. The most common causes are a lack of maintenance on the bolt, dirt or buildup on the bolt face, etc.
- Double Feed: A double feed is described in the same fashion as in the semi-automatic rifles. This malfunction is shooter induced.

- Failure to Fire: Failure to fire in a bolt gun is described in the same manner as in the semi-automatic section.

- Failure to Feed: A failure to feed is also decried in the same manner as the semi-automatic. The problem usually occur0s when the shooter bolt overrides the cartridge in the internal or external magazine.

- Advantages and Disadvantages in Various environments and situations

Although one rifle platform may surpass the other, we must also understand that that platform is only a tool for a certain task and may not be applicable in every situation. We can take a look at how each platform has an advantage and disadvantage by discussing different situations/environments.

Multiple Engagements

Precision Shooters can find themselves in a multiple target engagement situation not only in combat (defensive or offensive), but in a timed competition event as well. As we all know, holdovers and holdunders will greatly increase our speed at getting rounds on target, but when time matters the most, the semi-automatic rifle will by far surpass the bolt rifle. The amount of time it takes to run the bolt, acquire the target, and get a proper trigger squeeze on target is greater than that of the semi, as the shooter only has to transition through targets and apply a proper trigger squeeze while utilizing the trigger reset.

Urban and Woodland (Tactical)

In regards to the bolt rifle in an urban environment, speed, accuracy, and possible presentation of multiple targets play a big role in the selection of this rifle platform. While the bolt rifle may have the greater advantage in accuracy, which is commonly needed when engaging partially obscured targets at various ranges, it may lack in the speed needed to engage multiple targets.

The semi-automatic rifle while being superior in speed and engaging multiple targets, it make lack the accuracy needed to engage small partially

obscured targets, usually due to the shooter not properly driving the rifle while in various alternate shooting positions.

Aerial Platforms

As difficult in nature Aerial shooting can be, the amount of rounds used to engage a target are typically more than 3, due to the lack of a stable platform, the amount of time the shooter is actually on or able to engage the target, and proper lead needed to engage the target. This being the case, the semi-automatic rifle surpasses the bolt action.

Aerial Platform Shooting

Arial platform shooting is a topic that has become a growing topic for the precision shooter. We all have shooting movers down to almost a science by now, but what if the roles are reversed and the target is stagnant and the shooter is moving.

This chapter is especially important to the military and law enforcement community.

In Alaska, May 19, 1984, a killer known as Michael Allen Silka had been on the run in the wilderness for some time. Michael was an exceptional shooter with a long gun, and had recently killed a family of 3 including a 6 month old pregnant women and 3 year old child. The Alaskan state troopers were sent out to find the killer via helicopters, with no intent of shooting from an aerial platform. The troopers intended to land the helicopter near the scene of the recent family murder, but upon approach, Silka spotted the helicopter and raised his rifle to fire at the helicopter containing the troopers. Silka fired one round from his hunting 30.06 rifle at the troopers, missing them just above their head.

The troopers on board the helicopter were armed with M16 rifles, one trooper with his rifle set on fully automatic and the other troopers rifle set on semi. As the bullet passed over the troopers from Silka's rifle, the two troopers fired at Silka. The rounds fired at Silka missed due to neglecting the fact that they needed to perform what is known as a "negative lead".

When shooting moving targets and the shooter is stationary, the shooter must apply a "lead" in front of the target (discussed in volume 1) a prescribed hold. When the shooter is moving and the target is stationary, the shooter must aim behind the target to compensate for the forward movement of the vehicle or helicopter.

Reducing Rifle Vibration

Being able to successfully reduce all of the rifle vibration is nearly impossible. Being able to reduce some of the rifle vibration while in an

aerial platform however, is possible.

There are a few techniques that are being used by precision shooters in the law enforcement and military community. The techniques are as follows:

- Single strap method
- Spider Strap method
- Bag support method

Single Strap Method

The single strap method is the second fastest to set up method. This method can be built with 550 cord, a spare sling, or the sling from your rifle.

Once the shooter determines what piece of material he will use, he then secures each of the running ends to the sides of the interior of the platform. The sling or 550 cord should not be so tight that the rifle will easily move around. The sling or 550 cord should have slack. Take a look at the following picture, note the amount of tension on the sling:

Spider Strap Method

The spider strap method takes time to construct, but in return the shooter will have a very stable structure to shoot from. This method uses four pieces of 550 cord that are tied to the interior sides of the platform such as the doorway, and they meet at a circular device in the middle, such as a

covered/cushioned D ring. The front end of the stock rests within the cushioned D ring. The following picture will illustrate this method.

Bag Support Method

The bag support is not only the fastest to construct, but is as well a very stable shooting platform. The shooter may support the rifle utilizing a

rucksack, assault pack, luggage bag, etc. The following picture shows a sniper using the bag support method.

Please note that the bag is secured firmly to the interior floorboard of the aerial platform.

Proper Concealment for the Precision Shooter

Proper concealment for any precision shooter/sniper in my opinion, is at the top of the snipers list. The precision shooter that understands concealment has the advantage not only on the battlefield, but within the hunting and competitive community as well.

We can better understand proper concealment by breaking it down into the following:

Woodland
- The weapon
- The shooter
- The environment (Depth perception)
-

Urban: (Will be discussed in the following chapter "Tactical Urban Environment Precision Shooting (Advanced))"

Winter/Snow
- The weapon
- The shooter

Woodland

Woodland environments offer us a vast majority of natural concealment that we can use in our favor. We must take note that when utilizing natural vegetation, we have to be aware at all times of the environmental color and vegetation changes, as well as the density of the vegetation around us. When concealing ourselves, we must be sure to match our surroundings as closely as we can, avoiding us from standing out to a trained observer.

The Weapon

The typical pictures that we see of precision shooters camouflaged within a woodland/grassland environment, the weapon that the precision shooter is operating neglects to properly conceal it. The problem this presents to a

precision shooter, is the hard lines and contrast the weapon has, and to a trained, or even an untrained eye, is that it stands out like a sore thumb!

There are various ways to conceal a precision rifle. Some are good, and some are better, it depends on the shooters overall objective. Are you going up against a big game animal, a trained observer in a competition, or on the battlefield.

Scope

I like to start concealing my rifle with the biggest target indicator, this being the rifle scope. The rifle scope can be concealed easily by the use of natural vegetation, screens, paper/cardboard, etc.

We want to take enfaces on the scopes objective lens by placing a screen over it or natural vegetation directly on the lens itself. The reasoning for this is to prevent lens glare, or “the black hole”. The black hole is something that we snipers refer to when the observer looks into an area where the shooter is and notices a circular, dark object located within foliage. This is a dead giveaway of a “scope”, nothing in nature looks or resembles a rifle scope. You can easily conceal the scope objective lens by taking natural vegetation around you and sparsely placing it within the scopes objective lens. Your visibility will somewhat be obscured, but minimal. The magnification of the scope allows the shooter to “burn” through or see through the vegetation placed within. This is one of the preferred methods used by precision shooters due to the fact that it matches natural surroundings perfectly, unlike a hasty scope veil.

Be sure to only obstruct the lens as to where the observing party may not see on notice any shine/glare, and presents a one dimensional view.

Barrel/Stock

The next step to concealing the rifle is to properly conceal the barrel and stock. Your objective is to present a one dimensional flat object in relation to the scope and shooter.

In order for us to present this one dimensional object that blends and conceals itself with the environment, we need to break the outline of the rifle barrel and stock, as well as match the vegetation within the scope, shooter, and surrounding environments.

The Shooter

A properly constructed ghillie suit is the preferred method used to conceal the shooter in a woodland environment. The ghillie suit, also known as a yowie suit, or camo tent, is a type of camouflage clothing designed to resemble heavy foliage. Typically, it is a net or cloth garment covered in loose strips of burlap, cloth or twine, sometimes made to look like leaves and twigs, and optionally augmented with scraps of foliage from the area.

Snipers and hunters may wear a ghillie suit to blend into their surroundings and conceal themselves from enemies or targets. The suit gives the wearer's outline a three-dimensional breakup, rather than a linear one. When manufactured correctly, the suit will move in the wind in the same way as surrounding foliage.

High-quality ghillie suits are made by hand; most military snipers generally construct their own unique suits. Manufactured Ghillie suits can be assembled from up to six pieces. Proper camouflage requires the use of natural materials present in the environment in which a sniper will operate. Making a ghillie suit from scratch is time-consuming, and a detailed, high-quality suit can take weeks or even months to manufacture and season. Ghillie suits can be constructed in several different ways. Some military services make them of rough burlap flaps or jute twine attached to a poncho. Hunting ghillie suits can be made of nylon and other artificial materials as well as the ones listed before. United States military ghillie suits are often built using either a battle dress uniform (BDU), or a pilot's flight suit or some other one-piece coverall as the base.

On the base, rough webbing made of durable, stainable fabric like burlap is attached. A nearly invisible material like fishing line can be used to sew each knot of net to the fabric (often with a drop of glue for strength). The jute is applied to the netting by tying groups of 5 to 10 strands of a color to the netting with simple knots, skipping sections to be filled in with other

colors. The webbing is then seasoned by dragging it behind a vehicle, leaving it to soak in mud, or even applying manure to make it smell "earthy." Once on location, the ghillie suit is customized with twigs, leaves, and other elements of the local foliage as much as possible, although these local additions must be changed every few hours, due to wilting of green grasses or branches.

The shooter should also be aware to use 70 percent natural vegetation to 30 percent jute/burlap. The hood or hat should have a long “tail” on the backside of the hat. The tail will allow the shooter to turn it around and drape over the sights of the rifle.

The Environment (Depth perception)

When a sniper/precision shooter operates in a woodland environment, he may use depth perception as a means of concealment as well. When a sniper is able to throw off his exact location by means of throwing off his true depth within the environment, the observing eye will or may be able to see the sniper, but will not be able to determine his true distance. This can be an effective tool that a sniper can use. He will be able to put a few extra rounds if needed on a target before the observer is able to effectively determine the shooters true range.

Depth perception can be achieved by a technique called “tree stacking”.

In order for a sniper to use a tree stack, while on a stalk or setting up in an FFP, he can utilize the trees behind and in front of him and place his position somewhere in-between, in somewhat of a linear fashion. The trees should be stacked in a line and somewhat staggered as well. The shooter will have to use extreme precision when firing in order to “thread the needle” between the small gaps in the tree stack.

Hasty

A sniper can make a quick hasty concealed position with the utilization of a blind. The blind is very similar to that of a blind in the urban hide sight.

The blind is a colored burlap sheet, typically 4’x3’, with a stick or stake on each end used to insert into the ground. The blind can be easily rolled and carried in a kit bag. Although the blind may come with a camouflaged pattern, it should still contain at least 70 percent natural vegetation.

The shooter will place the blind in front of him by using the stakes and backing away from the blind at least 2 feet. Depending on the density of the blind constructed, he can use his optics to “burn” through, or cut a small section (3”x3”) out of the blind allowing him to see his target. The bullet passing through the blind will not be affected and thrown off its intended course to target.

Please note that this is to only be utilized hasty concealment for the shooter and not to be used when other forms of concealment are available.

Winter/Snow Environment

Concealing oneself in a snowy environment is of course one of the easiest, but still should be discussed, and offering a few techniques being used by snipers operating in the snowy mountains of Afghanistan.

Here are a few of the most used, up to date techniques precision shooters are using this environment.

The Weapon and Shooter

The weapon may easily be camouflaged to match the surrounding snowy terrain by either using burlap rags, cloths, or simply paint. In order for the shooter to remain concealed, he will wear the winter/snow suit. This suit is typically a two piece white suite, with blotches of black on it.

The inexperienced sniper will usually use a solid white color to match the white snow. This technique, though often taught, is not the correct way to properly conceal a shooters rifle.

Visible sunlight is white. Most natural materials absorb some sunlight which gives them their color. Snow, however, reflects most of the sunlight. The complex structure of snow crystals results in countless tiny surfaces from which visible light is efficiently reflected. What little sunlight is

absorbed by snow is absorbed uniformly over the wavelengths of visible light thus giving snow its white appearance.

Generally, snow and ice present us with a uniformly white face. This is because most all of the visible light striking the snow or ice surface is reflected back without any particular preference for a single color within the visible spectrum. The situation is different for that portion of the light which is not reflected but penetrates or is transmitted into the snow. As this light travels into the snow or ice, the ice grains scatter a large amount of light. If the light is to travel over any distance it must survive many such scattering events, that it must keep scattering and not be absorbed. The observer sees the light coming back from the near surface layers (mm to cm) after it has been scattered or bounced off other snow grains only a few times and it still appears white. However, the absorption is preferential. More red light is absorbed compared to blue.

Not much more, but enough that over a considerable distance, say a meter or more, photons emerging from the snow layer tend to be made up of more blue light than red light. Typical examples are poking a hole in the snow and looking down into the hole to see blue light or the blue color associated with the depths of crevasses in glaciers. In each case the blue light is the product of a relatively long travel path through the snow or ice. So the spectral selection is related to absorption, and not reflection as is sometimes thought. In simplest of terms, think of the ice or snow layer as a filter. If it is only a centimeter thick, all the light makes it through, but if it is a meter thick, mostly blue light makes it through.

Being that the color red is not prevalent in snow, what an observer will sometimes see is the hint of blue. The shooters rifle camouflage should have a small hint of light blue sprayed onto the burlap white strips, or a light blue scattered on the solid white paint on the rifle.

The sniper/precision shooter should not only use a small coating of lite blue on his snow suit and rifle, but should also include small black blotches scattered sporadically on the suit and rifle.

In order for the sniper to avoid the “black hole” of the scope, he can easily tape a piece of white paper with a small slit cut into it allowing the sniper to

see through his scope.

Over time, through an observers eyes or optic looking at a snowy environment, he will experience Photokeratitis, or snow blindness to some degree. Photokeratitis or ultraviolet keratitis is a painful eye condition caused by exposure of insufficiently protected eyes to the ultraviolet (UV) rays from either natural or artificial sources. Photokeratitis is akin to sunburn of the cornea and conjunctiva, and is not usually noticed until several hours after exposure. Symptoms include increased tears and a feeling of pain, likened to having sand in the eyes.

A sniper can use “snow blindness” as well to his advantage when in this environment. The shooter should take note of the targets eye protection in and around the area. If the observer or targets operating throughout are not utilizing proper eye protection over a period of time, he will not easily be detected as snow blindness will affect the observer’s vision.

Tactical Urban Environment Precision Shooting (Advanced)

This chapter will focus more on the law enforcement and military tactical precision shooters that may find themselves in urban environments.

Urban environments can be one of the most nerve racking places a sniper may find himself in. The sheer nature of population, shadows, lights, structures, etc., staying concealed and setting up a position will bring the sniper a great deal of challenges. With these challenges, also brings the sniper a great tactical advantage as well if the sniper properly applies the following topics that we will discuss in detail:

- Observation from the outside looking in
- Proper Route planning
- Proper Camouflage and Concealment
- Structural shooting
- Urban Final Firing Positions
- Deception
- Urban Kit Bag

Observation from the Outside Looking In

The sniper always operates in any environment with extreme caution. When operating in an urban environment, he should operate with a heightened sense of not only caution, but observation as well due the nature of his environment.

If a sniper can avoid non-threat targets as much as possible in the urban environment, he should always do so. Even though the non-threat targets may not present the sniper immediate danger, any avoidance of the occupying population is key.

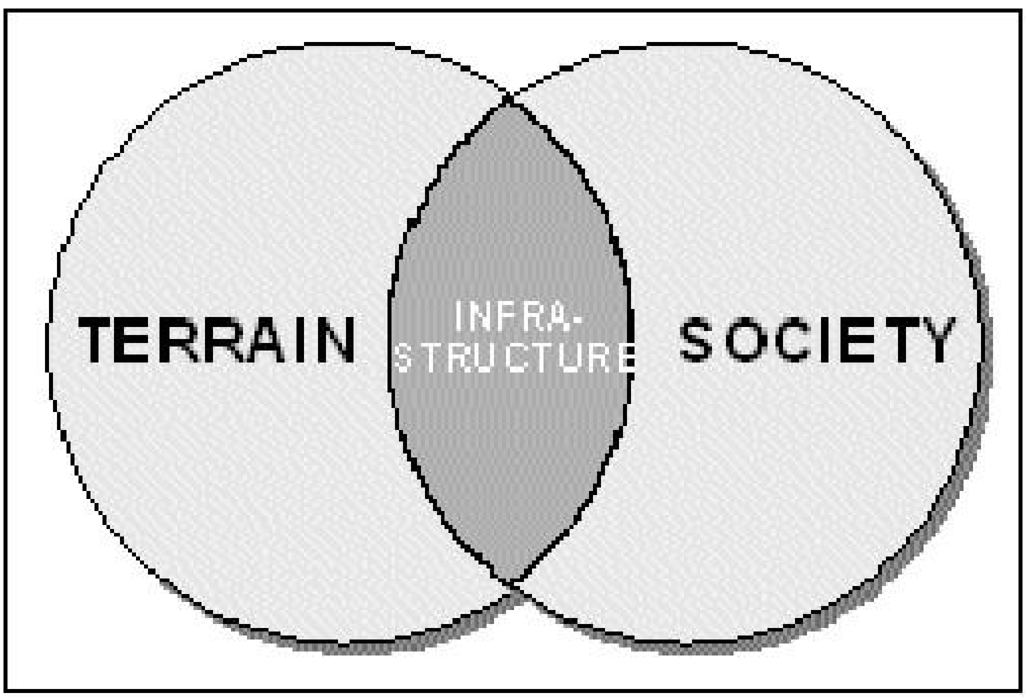
Here is a chart (Fig. 2-8.) to consider when occupying an urban population:

Category	Population
Village	3,000 or less.
Town	Over 3,000 to 100,000.
City	Over 100,000 to 1 million.
Metropolis	Over 1 million to 10 million.
Megalopolis	Over 10 million.

Figure 2-8. Urban Areas by Population Size

Although complex and difficult to penetrate, the terrain is the most recognizable aspect of an urban area. Truly understanding it, however, requires comprehending its multidimensional nature. The terrain consists of natural and man-made features, with man-made features dominating; an analysis considers both. Buildings, streets, and other infrastructure have varied patterns, forms, and sizes. The infinite ways in which these factors can intertwine make it difficult to describe a "typical" urban area. However, these elements provide a framework for
understanding the complex terrain in an urban area.

The Urban Society



Although intricate, understanding the urban terrain is relatively straightforward in comparison to comprehending the multifaceted nature of urban society. Even evacuated areas can have a stay-behind population in the tens of thousands. This population's presence, attitudes, actions, communications with the media, and needs may affect the conduct of a snipers operation. Homogeneity decreases drastically as the size of the urban area increases. Civilian populations continually influence, to varying degrees, operations conducted in an urban area. Thoroughly understanding these societal aspects and avoiding "mirror-imaging"-overlaying one's own values and thought processes on top of the person or group one is trying to assesswill help to accurately anticipate civilian actions and response.

The Key aspects of an Urban Society:

• Government and Politics
• Religion
• Population demographics
• Health
• History
• Leadership and Prominent personalities
• Ethnicity and Culture

Determining and fully understanding these aspects, will further assist you in your urban area of operation.

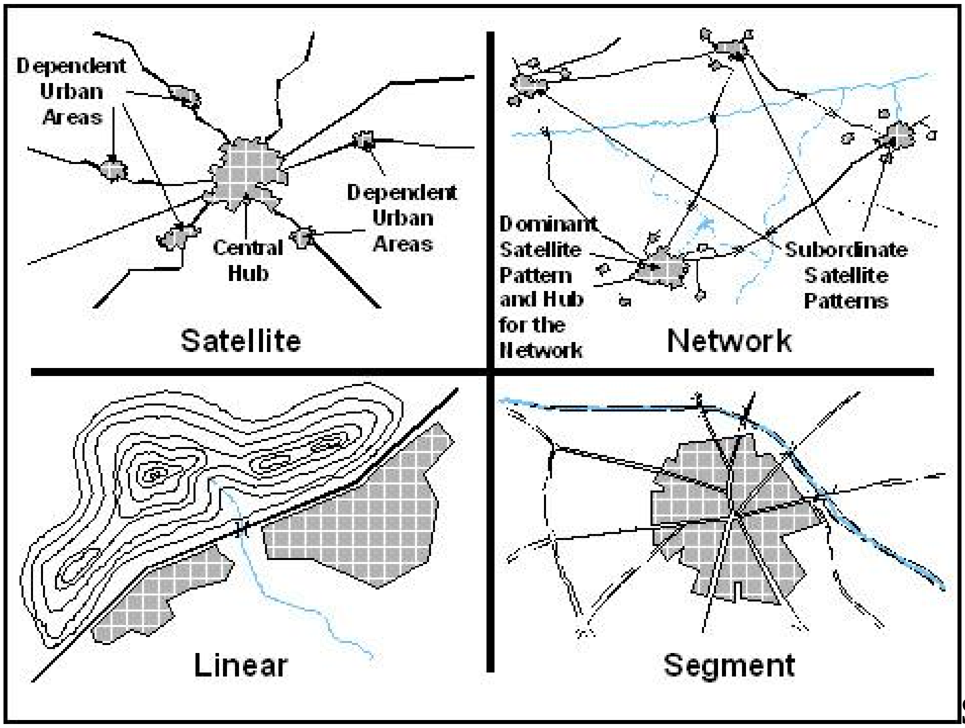
Proper Route Planning

A good route to the shooters FFP and extraction sets the difference between the experienced and inexperienced shooters.

A sniper uses several ways to determine his route selection depending on the makeup of the urban environment. The types of urban environments a sniper may find himself in are as follows:

• Satellite
• Network
• Linear
• Segment
• Radial

• Grid
• Irregular



Satellite

This common pattern consists of a central hub surrounded by smaller, dependent urban areas. The natural terrain throughout this pattern is relatively homogenous. Outlying areas often support the principal urban area at the hub with means of reinforcement, resupply, and evacuation. In some instances, they may serve as mutually supporting battle positions. Snipers should consider the effects of the outlying urban areas on operations within the hub, and, conversely, the effects of operations within the hub on outlying urban areas.

Network

The network pattern represents the interlocking of the primary hubs of subordinate satellite patterns. Its elements are more self-sufficient and less supportive of each other, although a dominant hub may exist. Major LOCs in a network extend more than in a satellite pattern and take more of a rectangular rather than a convergent form. Its natural terrain may vary more than in a single satellite array. Operations in one area may or may not easily influence, or be influenced by, other urban areas in the pattern.

Linear

Potentially a sub-element of the previous two patterns, the linear pattern may form one ray of the satellite pattern or be found along connecting links between the hubs of a network. Most frequently, this pattern results from the stringing of minor urban areas along a confined natural terrain corridor, such as an elongated valley, a body of water, or a man-made communications route. In offensive and defensive operations, this latter form of the linear pattern facilitates developing a series of strong defensive positions in depth, effectively blocking or delaying an attacking force moving along the canalized terrain.

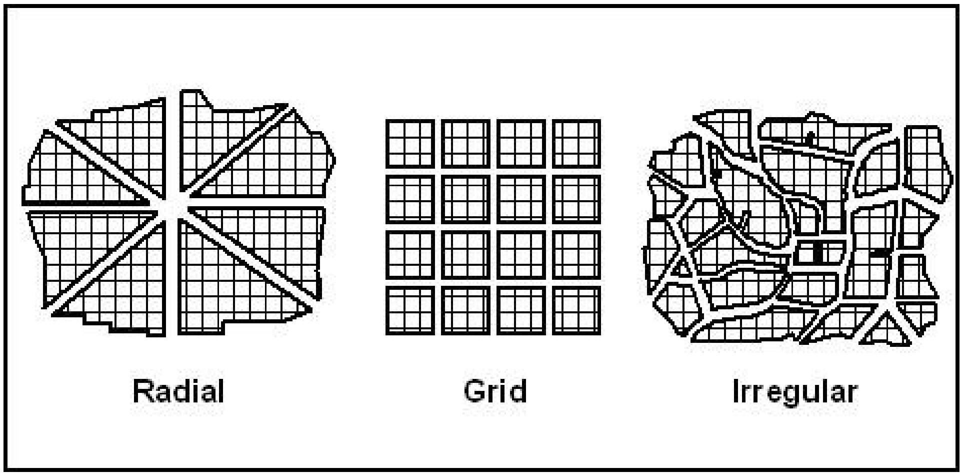
Segment

When dominant natural terrain, such as a river or man-made features (canals, major highways, or railways), divides an urban area, it creates a segmented pattern. This pattern often makes it easier for commanders to assign areas of operations to subordinate commanders. However, this

pattern may fragment operations and increase risk to an operation requiring mutual support between subordinate units. Still, the segmented urban areas may allow commanders to isolate threats more easily in these areas and focus operations within segments that contain their decisive points. Although an integral part of the whole (the urban area), each segment may develop distinct social, economic, cultural, and political

characteristics. This social segmenting may benefit commanders faced with limited assets to influence or control the urban populace. After thoroughly analyzing the society, they may be able to focus IO and populace and resources control measures against only specific segments that affect decisive operations. Commanders may need only to isolate other segments or may need to just monitor for any significant changes in the attitudes, beliefs, or actions of the civilians located there.

Street Patterns



Lesser patterns in the urban area result from the layout of the streets, roads, highways, and other thoroughfares. They evolve from influences of natural terrain, the original designer's personal prejudices, and the changing needs of the inhabitants. Street patterns (and widths) influence all BOS; however, they greatly affect maneuver, command and control, and combat service support. (In some portions of older Middle Eastern urban areas, the labyrinths of streets were designed only to allow two loaded donkeys to pass each other; tanks are too wide.) Urban areas can display any of three basic patterns and their combinations: radial, grid, and irregular

Radial

Societies of highly concentrated religious or secular power often construct urban areas with a radial design: all primary thoroughfares radiating out from the center of power. Cities with this design may signal an important historical aspect in the overall analysis of the urban society. Terrain permitting, these streets may extend outward in a complete circle or may form a semicircle or arc when a focal point abuts a natural barrier, such as a coastline or mountain. To increase mobility and traffic flow, societies often add concentric loops or rings to larger radial patterns. Unless commanders carefully plan boundaries, routes, and axes of advance, their subordinate units' movement or maneuver may be inadvertently funneled toward the center of urban areas with this pattern resulting in congestion, loss of momentum, and an increased potential for ambush or fratricide.

Grid

The most adaptable and universal form for urban areas is the grid pattern: lines of streets at right angles to one another forming blocks similar to the pattern of a chessboard. A grid pattern can fill in and eventually take over an original radial pattern. Grid patterns often appear to ease the assignment of boundaries for subordinates units. However, commanders also consider how the natural terrain influences operations and the establishment of control measures. They also consider the influence of the buildings and other structures lining these streets, such as their height and construction, before assigning boundaries and developing other control measures.

Irregular

In most urban areas, regardless of the original intent, plan, or vision, existing street patterns emerge from successive plans overlaid one on another. Some are well planned to fit with previous plans while others a haphazard response to explosive urban growth. The result may mix patterns. Urban engineers and planners may specifically design irregular patterns for aesthetic reasons (as in many suburban housing developments) or to conform to marked terrain relief. Irregular street patterns may alert commanders and analysts that the underlying natural terrain may exert greater influence over operations than in other portions of the urban area. Finally, irregular street patterns make the movement and maneuver of forces less predictable.

When looking and understanding the types of urban terrain, the sniper may orient himself with an overhead map view of the area, and take note of where the sun is located once the map is oriented. By orienting the map and observing the suns place in the sky, the shooter may take note of where the shadows will be casted.

A sniper should always stay well within the shadows when moving to a position, this is extremely important in the urban environment.

Be sure that when operating in the urban environment, you do not use the tallest or prominent structure as your FFP. The sniper should utilize a structure that does not stand out to the observer, such as a medium sized building in height. To get the added height needed to observe a target, the sniper can use the structures attic space by carefully punching small holes in shingles. Be sure to not only punch one single shingle out of the building’s

roof. The sniper should make multiple holes in the roofs shingles as to not stand out to any observing eyes.

Sound Deception

The sniper may also utilize sound deception to throw off any observers. When the shooter makes a shot in an urban environment, any observers within the area may easily pin point the shooter in a building structure.

In order to throw off any observers in the urban environment, he can use the sound deception technique. Due to classifications, this section will not discuss in depth, any techniques used to create this deception. Although, what we can discuss is the way sound moves.

Sounds moves a lot like the wind does in any environment. Sound will take the path of least resistance, just as wind. Depending on the way the sniper sets up the interior of the building, sound can be redirected, or muffled, and to the observer, the sound will seem to have originated in a different area or portion of the building.

Proper Camouflage and Concealment

In woodland and environments where snow is in the area, camouflaging yourself and your position is relatively an easy task.

Urban environments present various types of shapes, shadows, and textures. There are various ways that we can match the surrounding area around us successfully, in somewhat the same manner we would when utilizing a ghillie suit.

The first thing that we need to do is carefully observe our area of operation. Take note of the colors on the buildings in the area, colors inside the building, and the structures in and around the buildings as well. Not all urban environments look the same. Some environments may contain destroyed building structures (rubble in and outside the buildings), while some environments may be well kept in regards to maintenance.

In rubbish environments, the sniper can match his area of operation by using the following techniques:

Utilizing the Urban Rag Suit (Urban Ghillie): An urban rag suit (Fig. 11.1) is constructed of old, baggy, uniform (two piece or one piece) with neutral dark and light coloring, preferably one color. In order to break up the human outline, spray paint irregular blotches of darker and lighter neutral colors on the shoulders, chest, groin, and legs. A good rule of thumb to use when breaking up the human outline while wearing the suit, is to have the "outer human features" darker than the "inner human features". In other words, use darker blotches on the chest, shoulders, and thighs, and utilize lighter blotches on the neck area, stomach, groin, and shins. A hood that drapes over your head and shoulders will also be used as well, with very irregular blotches spray painted onto it in order to break up the very distinguishable head shape.

In conjunction with the rag suit, the sniper may further enhance his ability to blend in to the rubble terrain by adding dirt, fine rubble, and fine debris form the surrounding area to the suit, just as with the woodland ghillie. In order to do so, the sniper can utilize a spray adhesive, and spraying irregularly on the suit and rubbing it in the dirt, rubble, or add surrounding debris.

When camouflaging the rifle, spray paint and burlap will suffice. Be sure to conceal the scope lens and muzzle. This can be done by securing a piece of burlap over the lens and muzzle of the rifle.

• Making a Hasty Rag Suit (Urban Ghillie): The hasty rag suit is to be if the sniper finds himself transitioning from a woodland environment to an urban. This hasty suit will break the outline of the human body, and give the perception of shadows and highlights.

When the sniper finds himself in transition from woodland to urban environments, the sniper should utilize his B.D.U.'s, D.C.U.'s, or Mulitcam uniform and flip them inside out (wear the outside of the uniform against your body, exposing the inside of the uniform outward). The color pattern that is normally exposed, will present a "shadowy" color pattern while still effectively breaking your outline. To further break the features of your body and add "hard lines" to match an area that you may be operating in, the

sniper may use black electrical tape, placing it erratically on the suit, comparable to the hard lines around him.

Fig. 11.1

Structural Shooting/Reducing Shooter Signature

Typically in an urban environment, the sniper will find himself shooting from some type of structure, may it be a table, bench, car hood, chair, etc. These objects/structures will normally have some type of dust settlement on them. The importance of staying undetectable and concealed is of the utmost of importance.

When the sniper finds himself in an urban environment shooting from a structure, he must be not give away his position by “kicking dust”, commonly known to snipers who operate in woodland environments as “tossing salad”.

Kicking dust is a term used by urban snipers when signature amounts of dust is dispersed in to the air around the sniper, thus pin pointing his position. In order to get around this problem, the sniper may utilize a wet cloth, curtain, or something similar in nature, and placing it under the muzzle of the rifle.

A key trait in order to further reduce shooter signature that is often overlooked, is not only the snipers ability to alleviate “kicking dust”, but also the ability to pacify the signature sound of an empty brass cartridge hitting the ground.

The sniper can completely mask the sound of an empty brass cartridge ejecting from the rifle and hitting the ground by one of two techniques.

One technique used is to place a small bucket of water near the shooters position in order to catch the ejecting cartridge. The drawback to this technique is the amount of materials needed and the unpredictable landing of the brass ejecting from a semi-automatic rifle.

The most used technique to mask the sound is to place a cushion of some sort (mattress, seat cushion, bundled clothes, etc.) where the brass will land. Pouring water on the cushion will not only add to the masking of the sound, but will also prevent any “kicking dust”.

Urban Final Firing Positions/Construction

Once your target location is established and you’ve found the location where you will be operating from, it’s now time to set up a final firing position (FFP).

There are a plethora of FFP’s that can be used in an urban environment. The types that we will discuss are the building, rubble, and vehicle FFP’s.

Building FFP : The building FFP is the most commonly used position in the sniper community, which also means this is the first place an observer will most likely look in an engagement. If the sniper must use the building FFP, we need to discuss how to properly construct our position to benefit us.

The urban FFP should be constructed at a time when wondering eyes will not see you, this being at night. The first task the sniper needs to accomplish

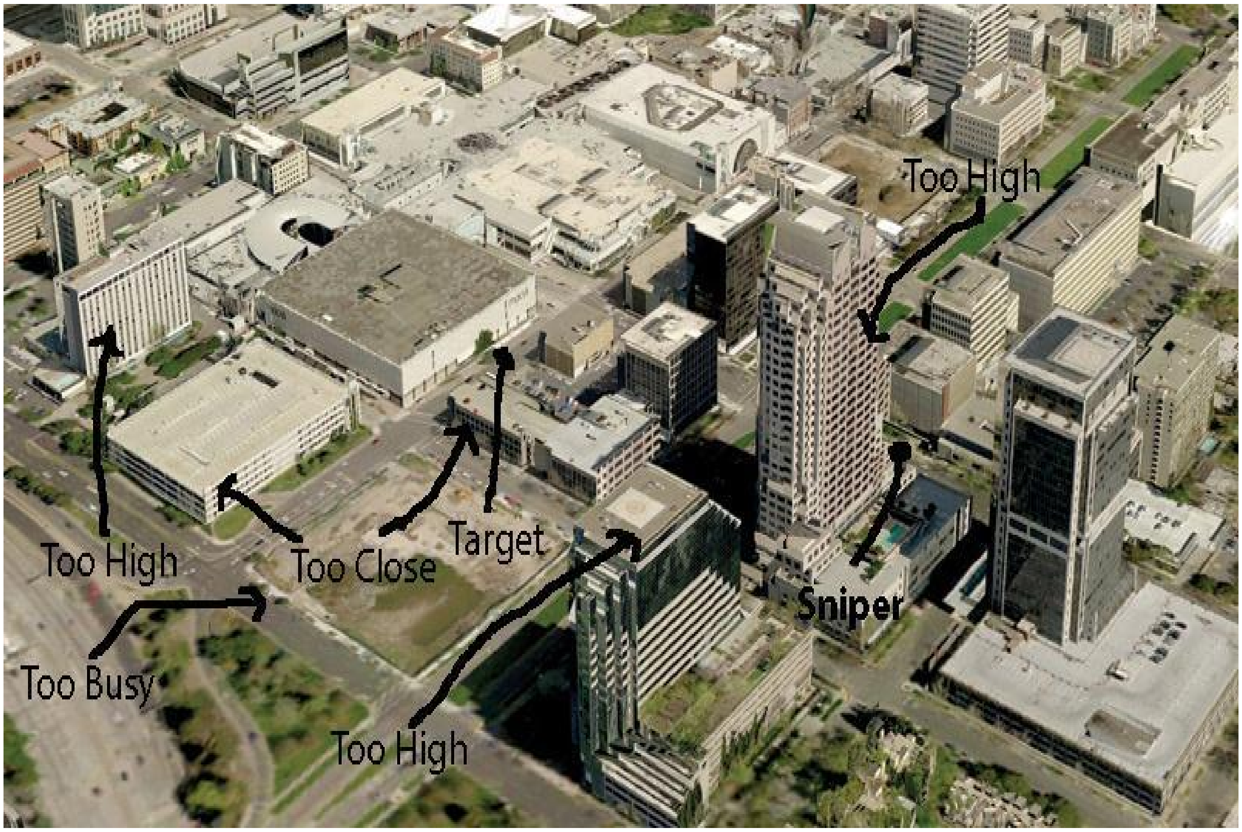
is successfully setting up a blind within the window or hole he will be shooting through. The blind will enable the sniper to work setting up the rest of his FFP/hide without easily being detected.

The blind is constructed of a dark, screen like material, in order to give the perception of a dark room to on looking eyes. The screen is placed at an angle, with the top portion of the screen secured to the top of the window/loophole and extending to the snipers platform.

If there are any doors inside the building, be sure to crack them (this will be explained in the deception section).

Once the blind and doors are in place and positioned, the sniper may now emplace his wet cloths and/or mattresses. The sniper should know that no more than 3-4 shots should be fired within this position, and the rifle barrel should sit back away from the opening of the window/loop hole by at least 3 feet.

If the sniper has the luxury of have a glass window which he will be shooting out of, he should either place the window in a position so that the bullet will just enough pass through cleanly, or carefully break a section out of the window without disturbing the position of the window.



*** *In the picture above, take a look at the snipers position. The building he is located on/in, is in a perfect position see the target, and uses the taller structure to his left, to cause deception. This may not be the ideal place for a sniper, but the amount of windows on the tall structure will confuse any observing eyes. The sniper also uses the structures around him to disrupt and redirect the echoes of the shot fired****

Rubble FFP : If the sniper is operating in a rubbish environment where a building or vehicle is not applicable, the sniper will utilize the urban rag suit. Be sure to place wet mats or cloths under the muzzle, on surrounding rubble near the muzzle (1-3 feet extending from sides of the muzzle), and in front of the muzzle (1-3 feet). If the sniper has the ability to stay within the shadows of rubble, do so!

Vehicle FFP: Using a vehicle as your FFP has its advantages as well as its drawbacks.

The vehicle FFP should only be used when the environment the sniper is operating in has multiple vehicles within it. The sniper should not utilize the vehicle FFP when the only vehicle within the area of operation is the one he will operate from, or an area where there are less than 15-20. The area where the vehicle FFP is to be utilized should be located in an area where there are a plethora of vehicles, such as a densely populated city, parking garage, etc. The sniper should also be aware of the fact that his mobility is also limited while using this FFP. These two key factors are a major drawback.

The advantage of using the vehicle FFP is the ability to use a tactic not commonly used and so unorthodox, that it will not be the first place an observer will look for, especially when vehicle is located in an area where buildings are present.

The setup of the vehicle FFP takes some time, and should be constructed during lowlight hours. Here are the steps needed to construct the vehicle FFP:

1) Find a vehicle that will be used. Typically a vehicle that does not stand out to an observer (destroyed, burned, flashy, etc.).

2) Once gaining entrance to the vehicle, the sniper needs to determine whether he will shoot through a loop hole made in the window, or shoot through a downed window. If the sniper will shoot through a loop hole, he can go about this by making a hole in the window (1-4 inches circumference) using a glass compass knife (fig. 1.11). Once the loop hole is made, the sniper place and secure a clear or tinted film over the hole, matching the window color type. If the sniper will shoot through a downed window, (either rolled down or broken) he will place the clear or tinted film over the window’s car frame, thus giving the perception that the window is present.

Fig. 1.11

3) Next the sniper needs to mask his movement within by denying visibility from on looking observers. In order to do so, the sniper should place screens around him, angling the screens to the center of the vehicle. Place a screen on all side window, front and rear windows by securing the top of the screen near the top portion of the windows and draping them to towards the center of the vehicle and securing the bottom portion of the screen. This gives the perception that the vehicle is unoccupied.

4) For a stable platform, the sniper may utilize 550 cord or bungee cord. The sniper may place the cord from one side of the vehicle interior to the other, and resting the rifle on the cord orienting the rifle muzzle in the direction of the film.

5) The ejecting brass will hit the screens surrounding the sniper, thus masking the sound.

Deception

Deception is used to fool the enemy into false conclusions about the location of a sniper or sniper team. There are a few ways a sniper can deceive on looking eyes near his position once the report of the rifle is heard. We will discuss two of the methods here in this chapter. It is up to the sniper to use his mind and things available to him to deceive on looking observers.

The first method we will discus, is the string pull method. The string pull method is best utilized when operating in a team. A sniper team operating in a building, the team may tie down certain objects such as blinds, curtains, screens, etc., in adjacent rooms or buildings, and extending the free end to the team's position. Once the shot is fired, the spotter will pull the string causing disruption in an adjacent room, and furthermore, giving the sniper added time to make a follow up shot without being detected.

*** Be sure that the window or room with the decoy in it, is not located on the same floor level as your team. It is preferred that the decoy is located diagonally and no less than 4 widows from your position.***

The next method is the dummy method. The dummy method dates as far back as trench warfare and was a great tactic not only used to determine a snipers location, but also to cause the enemy to expose himself to shoot the decoy, the real shooter which was in a different location, would then eliminate the enemy.

The sniper may also place a decoy in an adjacent room or window in an urban environment, and use this to draw fire or wondering eyes of observers to a false location once a shot has been taken.

Take a look at various decoy targets in the following pictures.

(Decoy human heads used in trench warfare.)


(Soldiers using a decoy to determine a snipers location.)


(A sniper in Iraq uses a decoy in an Urban environment.)

Urban Kit Bag

An urban kit bag should contain various items a sniper can use in an urban environment. Here are some items every urban sniper should carry in his kit bag:

• Screen/bling: Used to prevent or limit observing eyes, while giving the shooter the ability to observe targets by placing the screen at an angle over a

window or loop hole.

• Wire cutters: May be used to cut away small sections of fence or create a loophole in a fence.
• Electrical tape: May be used when constructing an urban sniper suit, securing blinds, etc.
• 550 cord: May be used as tie downs or shooting platform when secured between two or one objects.
• Veil: Used to conceal the shooters optics and breakup the human head outline.
• Collapsible tripod: Used as a shooting platform or platform for observation optics.
• Tinted plastic/film: May be used to match vehicles widows.
• Scrap cloth: Used to mask the sound of ejecting brass.

• Clear plastic/film: Used to match vehicles or building windows.
• Bungee cord: Used to secure items, or as a shooting platform.

• Glass compass knife: Used to cut a 1-12 inch circle in a glass widow.

Counter Sniper/Precision Shooter

For the precision shooter/sniper that finds him or herself in a counter precision shooter situation, this can be one of the most humbling and terrifying situations one can encounter. In order to prevail in this situation, one must completely understand every art form within precision shooting.

Being a sniper in the military in a time of war, and having been involved in a counter sniper operation, the information provided in this chapter will be a compilation of personal experience, doctrine, and history.

Personal Experience

During a deployment to Afghanistan serving as a sniper team leader in a special operations unit, my team had been tasked for a reconnaissance mission that would last for five days. During an approach to our final objective on day five, my recon team set up a position in an open field a few hundred yards from a nearby village. As the sun began to rise and shed light throughout the village, my team came under extremely accurate fire with rounds impacting within an inch or two from us.

I immediately knew that the incoming rounds had to be of the well-trained Chechen sniper who had been operating in that area. There were a few priorities that I had to determine so that I could accurately place rounds on target. These priorities are as follows:

• Where is the sniper? (field method)

• How far is the sniper? (field methods)
• What is the snipers weapon platform? (field methods)

Where is the sniper?

Being able to determine where a sniper may be or in fact, is, we first have to look at the situation that we are in and our environment. The environment will determine what methods we may have available to us in order to locate the sniper:

• Woodland
• Urban

Woodland

Locating an active sniper in a woodland environment can present a very challenging dilemma for us. Woodland environments with its endless amount of vegetation can offer the opposing sniper various forms of concealment if used properly.

When determining where a sniper is or may be, there are a few options we can use in to our advantage. The first method one can use to determine where a sniper may be, is common sense.

“Common Sense”

Common sense when encountering a counter sniper situation goes a long way. Hopefully, and more than likely, the sniper that we are up against, is far less trained than we are, and does not have the knowledge that we have gathered in the art of precision shooting.

When using common sense, take a look around and note any area that you as a precision shooter/sniper would be. This is typically in higher positions such as towers, tall buildings, etc., this gives the counter sniper confidence in being able to see the large area. His downfall of being in a tall structure, is that it will be the first thing that the human eye will draw to.

“Shine”

If we are able to have eyes on the area where the sniper may be (safely), we need to use our target detection skills and start to identify target indicators. Be aware of the suns position when identifying any indicators. If the sun is to your 6 o’clock position, start identifying any shine or glint. If hard lines are hard to differentiate (natural or manmade) in a woodland environment, take note and closely examine any “sheen” that may emit itself on any hardline, such as a sheen emitting itself from a piece of bark on a tree, for it may not be bark on a tree but instead a snipers scope lens.

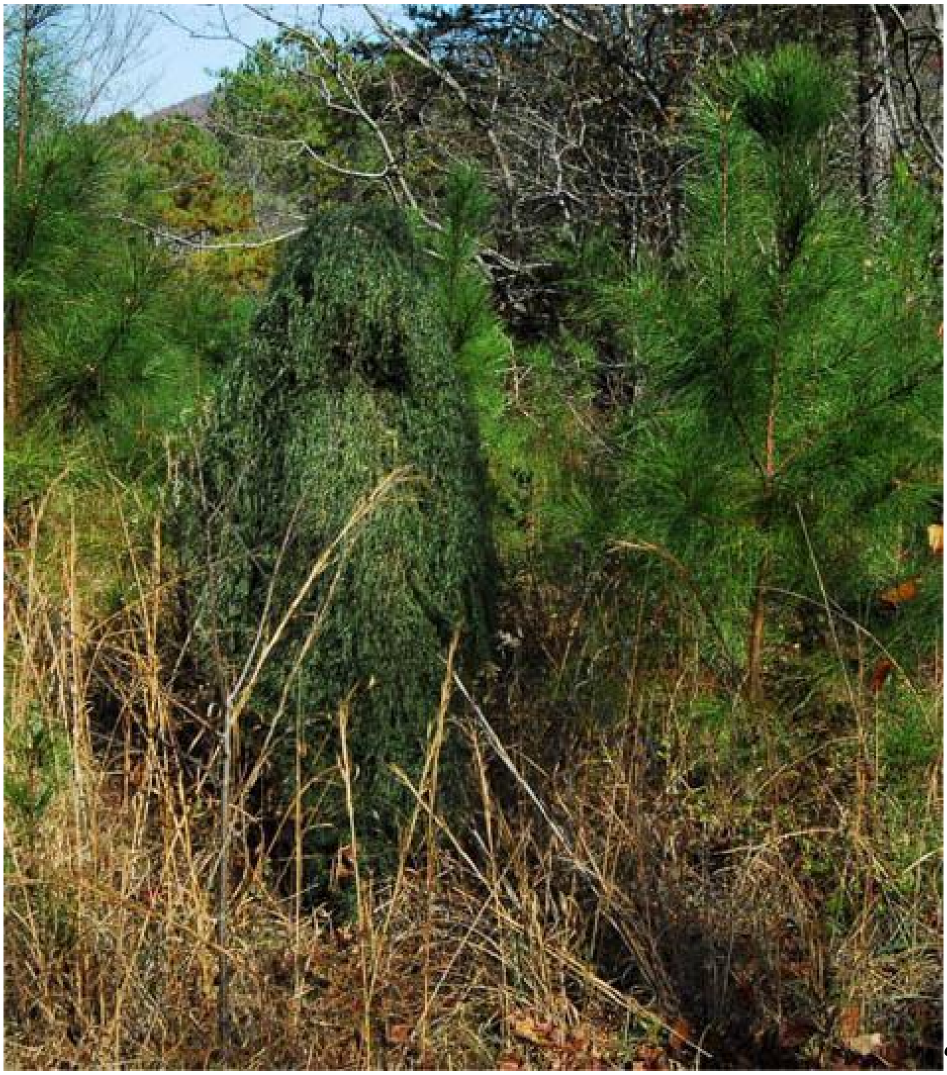
“Over Vegetation”

Be aware of any over vegetation in a certain area, such as in a woodland environment. There is nothing in a woodland environment that looks like burlap or jute.

You can usually find an over vegetated sniper by the lay and bulk of his camouflage in relation to the surrounding terrain. If the opposing sniper is over vegetated in relation to the surrounding terrain, you will note a change in color and shades. Being that the sniper is over vegetated, he will present himself as a dark void in terrain. This is featured in the picture below:

In the following picture, the sniper has over vegetated himself along with a bad position (tree cancer). The sniper is located in the center of the photo. You can pick him out by the shadows where the shoulders lay due to over vegetation and the bulk in an area where the terrain is relatively flat.

Another example of over vegetation is shown here below. Although the sniper is using a ghillie suit, he is using nothing more than a ghillie suit with too much jute, and no natural vegetation. Note the large darkness he presents.


“Improper Backdrop”

Being able to successfully match the background/backdrop of the sniper may not be considered to the improperly trained or novice shooter. Successfully matching the backdrop of the terrain in any environment, will give a sniper the ability to prevent silhouetting.

If the backdrop is not properly matched to the shooter, he will present give off an outline of a human shape, this typically being the shoulders and head.

“Tree Cancer”

Tree cancer is one of the snipers biggest giveaways when it comes to spotting him. To an inexperienced sniper, he will find a place where he feels

safe and will protect him from incoming fire, also known as cover.

In a woodland environment, cover is found behind a tree, downed log, etc. If the opposing sniper is lying on the side of a "cover" object, expecting it to both provide cover and concealment, he will present himself as a growth on that object. For instance, if he is laying behind a tree, with only his firing side and rifle exposed, no matter the excellence of his camouflage, he will still present himself as an un natural growth on the side of the tree, hence the phrase, "tree cancer". Tree cancer can be seen in the following picture:

*** Even though this picture is a side view, we can still see how tree cancer can stand out when looking at him. Note the bulge the sniper presents.***

"Improper Concealment/Camouflage"

This section will discuss exploiting the opposing snipers ability to properly conceal himself correctly, camouflage the minutest objects.

More often than not, the opposing sniper will neglect to properly conceal the following objects:

• Lens cap
• Objective lens
• Hands/gloves
• Non-Firing shoulder
• Bipods, Muzzle/barrel

Lens Cap : Negligence in covering the lens cap, to the observer looking onward, the lens cap will stand out as a circular void. (Fig. 6.3)


Fig. 6.3

Objective lens : The objective lens when not properly concealed will also present itself as a circular black void, often referred to as the black hole to observing eyes.

Hands/gloves : Rarely do you come across an opposing sniper that will go out of his way to match his hand/glove concealment with surrounding terrain. Even if the sniper conceals himself properly, the hands will also present a “void in space”. If the sniper is shooting a bolt action rifle, any observing eyes will see the motions of the hands/void manipulating the bolt.

Non-firing shoulder : By not properly concealing or neglecting to conceal the non-firing shoulder, the opposing sniper will give the observer the unmistakable outline of a human shoulder and sides. Once this can be determined, the observer may then start to make out the outline of the head, torso, etc.

Bipods, muzzle, and barrel : The picture below displays the negligence of a sniper properly concealing his bipods, muzzle, and barrel. Even though painted to somewhat match the terrain, without proper natural vegetation applied to the rifle, his position stands out like a sore thumb.

“Flash-Bang”

In this method, range is determined by counting the seconds between the time that you see the flash and when you hear the sound of the gun firing. You can count the seconds by counting one-thousand-one, one-thousand-two, and etc., with each count being one second. Since sound travels through the air at a speed of about 330 meters per second, each second you counted equals 330 meters.

To determine the range to a firing weapon, watch for the flash of the weapon when it fires and start counting seconds immediately. The number of seconds you count, multiplied by 330, will give you the approximate range from the target to your position. If you must count higher than ten seconds start over at one. The same method is used during hours of darkness.

As an alternative, since light is so fast, you can simply multiply the seconds you counted by 340 to estimate the distance in meters (340 is approximately the speed of sound in m/s, and light is of the order of magnitude of 10^8 m/s so it will not affect your estimate by a meaningful amount) For example: 3 seconds times 340 gives you 1020m.

"Snap-Bang"

The term snap bang, refers to the snap of a rifle round passing near you (the observer) and the bang of the report of the rifle.

Since the bullet is moving faster than the speed of sound, we hear the bullet "snapping" overhead first, before actually hearing the "bang" of the bullet being fired from the rifle.

This is very similar to thunder and lighting. Lightning, of course is moving faster than the speed of sound and is moving at the speed of light (186,000 miles per second or 983,571,058 ft/s.). During a thunderstorm, we see the lighting first then we hear the thunder. When determining how far a thunderstorm is we can use a simple counting method, of course this scale will vary when relating to a bullet and the report of a rifle.

The enemy's supersonic bullets produce a sonic boom, creating a "crack" sound as they pass by. If the enemy's bullet speed is known, his range can be estimated by measuring the delay between the bullet's passing and the sound

of the rifle shot, then comparing it to a table of values. This is only effective at distances of up to 450-500 meters; beyond this, the delay continues to increase, and at a rate too small for humans to distinguish accurately. Also, in urban areas, the sound can give inaccurate results due to the fact that the buildings in the area can relay false sound directions.

We will give an enemy’s bullet velocity a solid number of 2,700 fps.

A bullet leaving the muzzle at 2700 fps, (900 yards per second). At 100 yards the bullet has dropped to around 2,500 fps. We can average the velocity over the 100 yards to be approximately 2600 fps. At 2,600 fps, the 100 yards will be covered in about an eighth of a second, a number you will not be able to distinguish between snap and bang.

Being that bullets slow down the further that they fly, at around 500 yards, the bullet has a velocity of around 1800 fps (600 yards ps.), the space between you (the observer in this case) hearing the snap, and then hearing the bang, which is a “constant” (the speed of sound), will be about a second. So if we can distinguish a second or more, we can start to look for a sniper at around 500 yards or more. Anything that is less than a second, but still able to distinguish between a snap and bang, then you should start observing an area 200-400 yards away from where the rifle report (bang) was heard.

“Over Exposure of the Barrel in a Wood line”

Over exposure is when the opposing sniper exposes too much of his rifle or himself. This is typically seen when an inexperienced sniper is not confident with his shooting ability, especially in a woodland environment.

The inexperienced will typically use as much muzzle clearance as possible, ensuring that his bullet will successfully clear any obstacles. Although this will greatly reduce any “toss salad”, it will also present to the observer an overly exposed barrel that resembles a horizontal shiny or glossy “stick” poking out in the open.

Urban

“Flash, Bang, and Echoes”

If the opposing sniper is located in an urban environment such as a building, the snap-bang method may not be suitable for determine his location since the lay of the building interior may obscure, or present a false (muffled or silence) report of the "bang".

The Flash bang method is the most preferred method used when determining the distance and location of a sniper in an urban environment. The term "flash bang" doesn't necessarily refer to flash of the muzzle, but can also be referred to as kicking dust, curtain disturbance, etc.

If the sniper has a general location of the opposing, he can look and observe behind sufficient cover, for a muzzle flash, or kicking dust. Once this has been seen the sniper can then

follow the steps discussed previously in the woodland "flash bang method".
Please note that this tactic works best in lowlight urban environments.

Snap-Bang Method Chart (.308 168gr, HPBT Match)

Bullet Travel Time vs. Sound Travel Time

Distance Bullet/Snap Bang Difference
100 yards .12 .27 .15
200 yards .25 .54 .29
300 yards .39 .81 .42
400 yards .54 1.08 .54
500 yards .70 1.35 .65

The Maximum Practical Distance 600 yards .88 .60 .72

"One Second Five Count"

Another technique a sniper may use to determine another's sniper location is to use the "one second five count". The one second five count is done by counting to five in one second. This count starts when you hear the snap of the bullet, and stops when you hear the bang. Each number equals that many hundreds of yards: i.e., "three" is 300 yards, "four" is 400 yards, etc. This technique has been shown to accurately locate the distance of sniper within 30 yards. Please note that this technique, as discussed, is only accurate up to around 500 yards.

“Shadows and lighting”

Without the proper use of backdrops, blinds, and camouflage, an enemy sniper will be easier to find in an urban environment. Depending on the suns direction in the sky and manmade lighting within the building structure, if the sniper is not properly concealed, he will present himself as a dark or shiny “blob”. Inexperienced snipers that I have seen in combat, have usually used a poor choice of camouflage and backdrops, giving away their position.

“Use of Loopholes”

The snipers ability to successfully use a loophole correctly is crucial in urban environments. Luckily for us, the majority of enemy snipers that I have seen, have not used them correctly.

Enemy snipers will normally expose the rifles muzzle through a window, or over a ledge, whether it’s something that they’ve seen in movies or not, I’m not sure. When they expose the muzzle of the rifle through a loophole and resting it on a barrel, it gives us two advantages. The first advantage being the inaccuracy due to the barrel resting on a solid object, and the second being the rifle is exposed, presenting a hard, solid line object exposed, presenting a non-natural feature for this type of environment.

The picture featured in this section (Pic. 12.4) will point out the typical mistakes an enemy sniper will make in an urban environment.

There are a ton of mistakes in the picture featured on the following page. Let’s take a look at what the sniper did wrong.

1) Incorrect usage of the room. This sniper would have been better off positioning himself deep within the room to avoid the lighting and shadowing on his face and rifle.

2) The resting of the rifle barrel on the window seal will only decrease the shooters accuracy.
3) Improper camouflage. The sniper simply did not adequately use proper camouflage to match his surroundings.

4) The sniper has no screen/blind to give the observer the presence of an empty room.
5) Being that the muzzle of the rifle is directly on the seal of the window, not only will this produce “kicking dust”, but also greatly disturb the blinds above the muzzle.

6) The spotters around him are overly exposed.

Pic. 12.4

What is the snipers weapon platform?

Determining an opposing snipers platform has its benefits and disadvantages.

This technique should be referred to as an absolute method, but as a general rule of thumb. I found this technique useful in determining a snipers weapon of choice against a Chechen sniper while deployed to Afghanistan.

The first thing you need to do is observe the area of operation you are located in. If you are in a third world country, the typical sniper rifle of choice is the Dragunov SVD. The SVD is a semi-automatic sniper rifle/designated marksman rifle chambered in 7.62x54mmR and is the standard squad weapon of several countries, including those of the former Warsaw Pact. The extreme vertical spreads for the SVD are established by

shooting 5-shot groups at 300 m range. The accuracy requirements demanded of the SVD with sniper grade ammunition are similar to the American M24 Sniper Weapon System with M118SB cartridges (1.18 MOA extreme vertical spread) and the M110 Semi-Automatic Sniper System with M118LR ammunition (1.27 MOA extreme vertical spread).

If you are a law enforcement officer operating in the United States, the most popular precision/sniper rifle used is the civilian version of the M24. The M24 (Remington 700) is a bolt action rifle chambered in 7.62x51mm NATO (.308 win). It feeds a 5 round internal magazine with a "manual" maximum effective range of 875 yards, with an expected accuracy of 1 MOA using M118 and .5 MOA with the M118LR.

In order to determine the platform the sniper is using (semi vs. blot), you can count the seconds in-between shots fired.

The mad minute record was set by a Sgt. Snoxall in 1914. He fired 38 rounds on a 12 inch target at 300 yards in one minute with a Lee Enfield. The expert precision shooter can accurately fire around three rounds in four seconds. An average, let alone inexperienced sniper, can manipulate a bolt rifle accurately with around 2 rounds in five seconds (not a moving target). The time in-between the shots is approximately 2.3 – 2.5 seconds.

The sniper that uses the semi-automatic rifle can fire approximately half that speed (in relation to the bolt action). This information can be considered when determining if the opposing sniper is using a bolt, or semi-automatic sniper rifle.

Angle to Sniper

Angle to sniper is used to determine not only approximately how far the sniper is, but his location as well.

You can locate an opposing enemy sniper by using a field expedient "back azimuth". Be aware that you may or will be in the snipers field of fire, and this technique should be done with extreme caution.

The first thing that you need to accomplish, is find one of the snipers bullet holes, which may it be in a building, vehicle, tree, curb, etc.

The next task you need to accomplish is to covertly insert a straight rod of some sort into the hole. The direction, in which the rod is pointing, is where the general direction of the sniper is. In order to find his approximate distance, you can take the angle of the rod in relation to the ground.

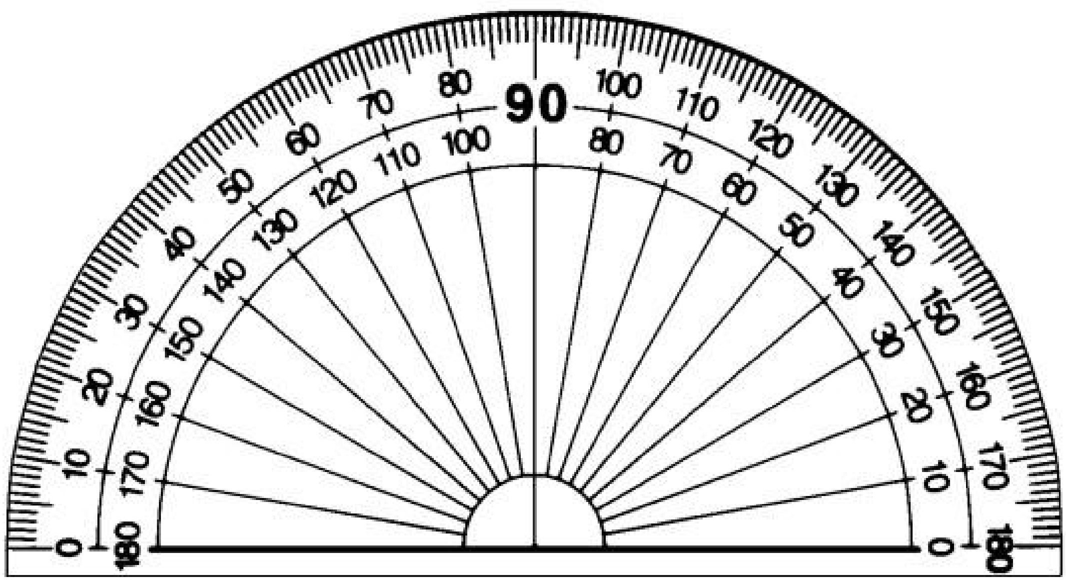
Once the rod is inserted, you must note if the rod is in one of the following states:

• Flat
• Slight Descending
• Plunging

A relatively flat trajectory indicates that the sniper is less than 250 yards away. The rod is also seen as angles less than 15 degrees on a protractor. This position is known as Flat.

An angle of 20 to 30 degrees indicates a snipers location at approximately 250 to 450 yards away. This is known as Slight Descending.

With an angle of 35 to 45 degrees, the snipers position is approximately 450 to 500 yards away. This is known as Plunging.



Doctrine

A friendly sniper is generally the most effective countersniper tool. With similar training, knowledge of the
surroundings, and equipment, the friendly sniper can offer advice to the squad, enhanced searching capability, and a means to combat the enemy sniper directly. When told what to watch for, the squad can also act as additional eyes and ears for the friendly sniper. Aside from watching over the squad, the friendly sniper also has the option to detach and engage the enemy sniper. Without any outside help from the squad, the respective skills of each sniper play a significant role in determining victory. A sniper duel can frequently distract the enemy sniper from his mission.

Here are of the three most common ways a sniper can accurately locate his opposing sniper:

• Triangulation: A Technique at two or more locations can more accurately identify the position of a sniper at the time of firing.

• Sound delay ("crack-bang"): The enemy's supersonic bullets produce a sonic boom, creating a "crack" sound as they pass by. If the enemy's bullet speed is known, his range can be estimated by measuring the delay between the bullet's passing and the sound of the rifle shot, then comparing it to a table of values. This is only effective at distances of up to 450 meters; beyond this, the delay continues to increase, but at a rate too small for humans to distinguish accurately. Also, in urban areas, the sound can give inaccurate results because the buildings in the area can relay false sound directions.

• Detector: The 'sniper detector' system, named Boomerang, was developed through the Defense Advanced Research Projects Agency and can determine the bullet type, trajectory, and point of fire of unknown shooter locations. The system uses microphone sensors to detect both the muzzle blast and the sonic shock wave that emanate from a high-speed bullet. Sensors detect, classify, localize and display the results on a map immediately after the shot. The system sensors are usually mounted on a vehicle. The United States military is also funding a project known as RedOwl, which uses laser and acoustic sensors to determine the exact direction from which a sniper round has been fired. The RedOwl system has been tested on the PackBot robot from iRobot Corporation.

The Counter-Sniper Detector:

A counter sniper detector/device (the majority) are based on acoustic measurements. The two distinctive observable acoustic events are the muzzle blast and the acoustic shock wave, the sonic boom produced by a supersonic projectile.

The main limiting factor in standalone systems is the requirement for line of sight, which is a major impediment in urban environment. In fact, the performance of most of the current acoustic systems significantly degrades when used in the concrete jungle, since some of the few available sensor readings are typically corrupted by multipath effects.

A wireless sensor network-based approach can eliminate this problem. Instead of using a few expensive acoustic sensors, a low-cost ad-hoc acoustic sensor network measures both the muzzle blast and shock wave to accurately determine the location of the shooter and the trajectory of the bullet. The basic idea is simple: using the arrival times of the acoustic events at different sensor locations, the shooter position can be accurately calculated using the speed of sound and the location of the sensors.

"The Boomerang"

Boomerang grew out of a program conceived by the U.S. Department of Defense in late 2003, months after the traditional combat phase of the Iraq War had ended on 1 May, at a time when it was clear that U.S. troops were increasingly at risk from a growing and aggressive insurgency. Often, troops in noisy Humvees did not know they were being shot at until someone was hit. U.S. Defense Secretary Donald Rumsfeld approached DARPA and asked for near-term solutions that could be applied to the conflict in Iraq. Rumsfeld was looking for something that did not have to be a perfect solution, but was at least better than nothing.

The requirements included:
• Shooter localization to plus or minus 15 degree accuracy, and within one second of the shot
• Reliability for shot miss distances of one to 30 meters
• Ability to detect and localize fire from AK-47s and other small arms at

ranges from 50 to 150 meter
• Reliable performance in urban environments with low buildings.

• Operable when mounted on a vehicle moving up to 60 miles per hour on either rough terrain or highways.
• The ability to withstand sand, pebbles, rain, and light foliage impacts ability to deliver alert information in both a voice announcement and on an LED display

• Microphone array and electronics box must be replaceable in the field.

The Boomerang unit attaches on a mast to the rear of a vehicle and uses an array of seven small microphone sensors. The sensors detect and measure both the muzzle blast and the supersonic shock wave from a supersonic bullet traveling through the air (and so are ineffective against sub-sonic ammunition). Each microphone detects the sound at slightly different times. Boomerang then uses sophisticated algorithms to compute the direction a bullet is coming from, distance above the ground and range to the shooter in less than one second.

Users receive simultaneous visual and auditory information on the point of fire from an LED 12-hour clock image display panel and speaker mounted inside the vehicle. For example, if someone is firing from the rear, the system announces "Shot, 6 o'clock", an LED illuminates at the 6 o'clock position, and the computer tells the user the shooter's range, elevation, and azimuth.

Boomerang works in extreme weather, in open field and in urban environments, whether static or moving. BBN states that false shot detections are less than one per thousand hours of system operation at vehicle speeds under 50 miles per hour.

Counter Sniper History

One of the best counter sniper stories that I have heard, read, and studied, is that of Gunnery Sergeant Carlos Norman Hathcock II.

Sgt. Hathcock is not only known for his 93 confirmed kills during the Vietnam war, but also for one of the most impressive mission records of any

sniper in the Marine Corps.

The North Vietnamese Army placed a bounty of $30,000 on Hathcock's life for killing so many of their men. Rewards put on U.S. snipers by the N.V.A. typically ranged from $8 to $2,000. Hathcock held the record for highest bounty and killed every Vietnamese marksman who sought it. The Viet Cong and N.V.A. called Hathcock Lông Trắng, translated as "White Feather", because of the white feather he kept in a band on his bush hat. After a platoon of trained Vietnamese snipers was sent to hunt down "White Feather", many Marines in the same area donned white feathers to deceive the enemy. These Marines were aware of the impact Hathcock's death would have and took it upon themselves to make themselves targets in order to confuse the counter-snipers.

One of Hathcock's most famous accomplishments was shooting an enemy sniper through the enemy's own rifle scope, hitting him in the eye and killing him. Hathcock and John Roland Burke, his spotter, were stalking the enemy sniper in the jungle near Hill 55, the firebase from which Hathcock was operating. The sniper, known only as the 'Cobra,' had already killed several Marines and was believed to have been sent specifically to kill Hathcock. When Hathcock saw a flash of light (light reflecting off the enemy sniper's scope) in the bushes, he fired at it, shooting through the scope and killing the sniper.

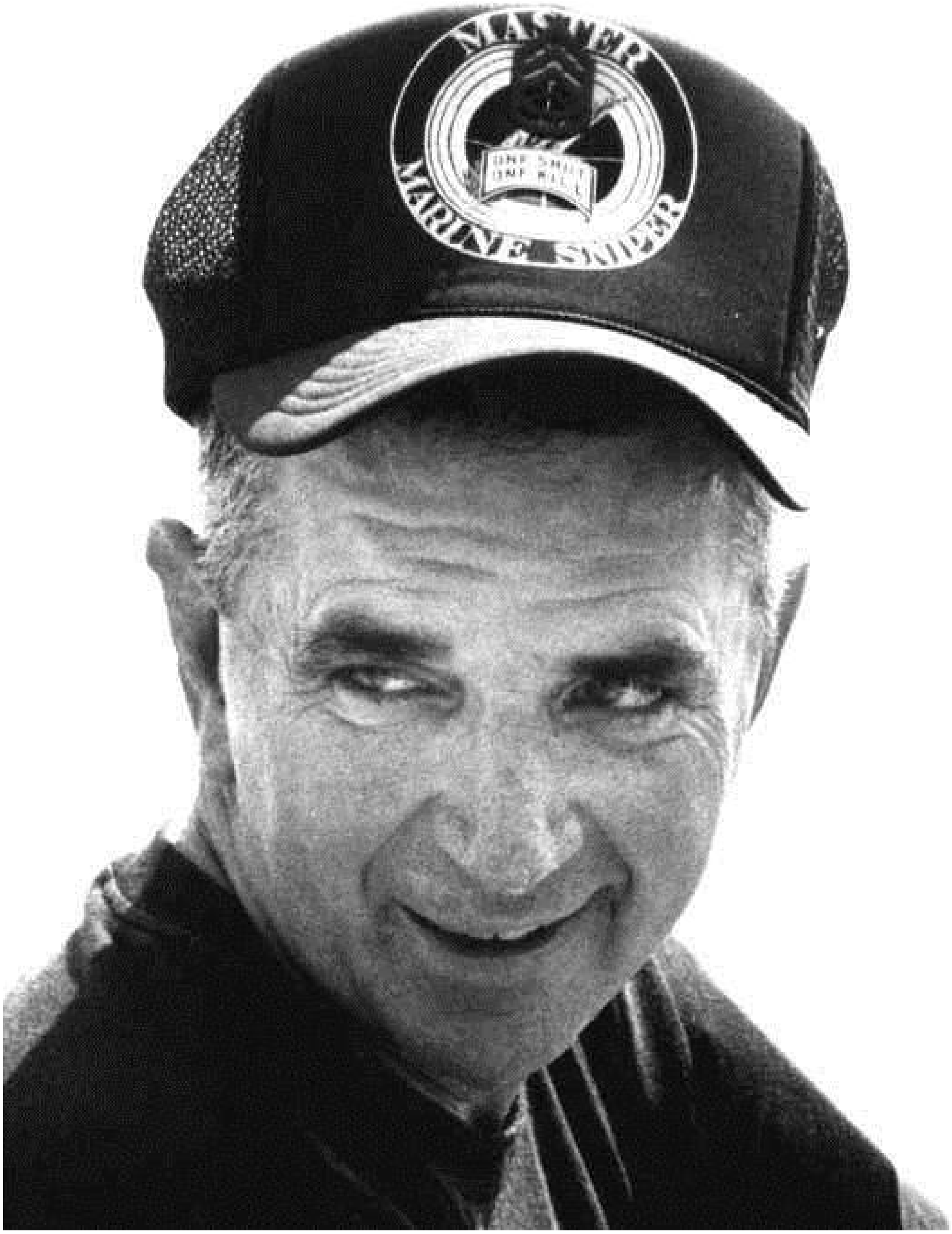
Surveying the situation, Hathcock concluded that the only feasible way he could have put the bullet straight down the enemy's scope and through his eye would have been if both snipers were zeroing in on each other at the same time and Hathcock fired first, which gave him only a few seconds to act.

Given the flight time of rounds at long ranges, both snipers could have simultaneously killed one another. Hathcock took possession of the dead sniper's rifle, hoping to bring it home as a "trophy", but after he turned it in and tagged it, it was stolen from the armory.

A female Viet Cong sniper, platoon commander, and interrogator known as "Apache", because of her methods of torturing US Marines and ARVN

troops and letting them bleed to death, was killed by Hathcock. This was a major morale victory as "Apache" was terrorizing the troops around Hill 55.

The importance of this story to a sniper in a counter sniper operation, is the simple fact that Carlos spotted the enemy by nothing more than the “shine” of the scope, and having the accuracy needed to hit the glint. This should give you an idea of the type of situational awareness and accuracy you will need when, or if you find yourself in a counter sniper situation.



Marine Sniper Carlos Hathcock (93 confirmed kills)

May 20, 1942 – February 23, 1999

ABOUT THE AUTHOR

Nicholas G. Irving

• US Army Joint Special Operations Command (3/75 Ranger Regiment
• US Army Joint Special Operations Command (3/75 HHC Sniper)

• Iraq Campaign
• Afghanistan Campaign
• Master Sniper
• Demolitions Expert

• Sniper Instructor for various personnel and organizations (F.B.I, Special Operations, H.R.T, S.W.A.T, Secret Service, L.E. Counter Snipers, A.T.F, Civilians, etc.)

• 33 Confirmed Sniper Kills with over 15 probables in a 3 month time span while serving in Afghanistan

• Designated Marksman
• Private Security Contractor

• Awarded “Valorous Device” while serving as a sniper in Afghanistan

• Sniper Team Leader
• Ranger School
• US Army Sniper School
• International Sniper Competition (4th Place)
• Sniper Urban Warfare
• Long Range Precision Course x3
• High Angle Course
• Extreme Range Course (1300 yards to
• Etc.

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